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The Distribution of Kemp's Ridley Sea Turtles (*Lepidochelys kempi*) Along the Texas Coast: An Atlas

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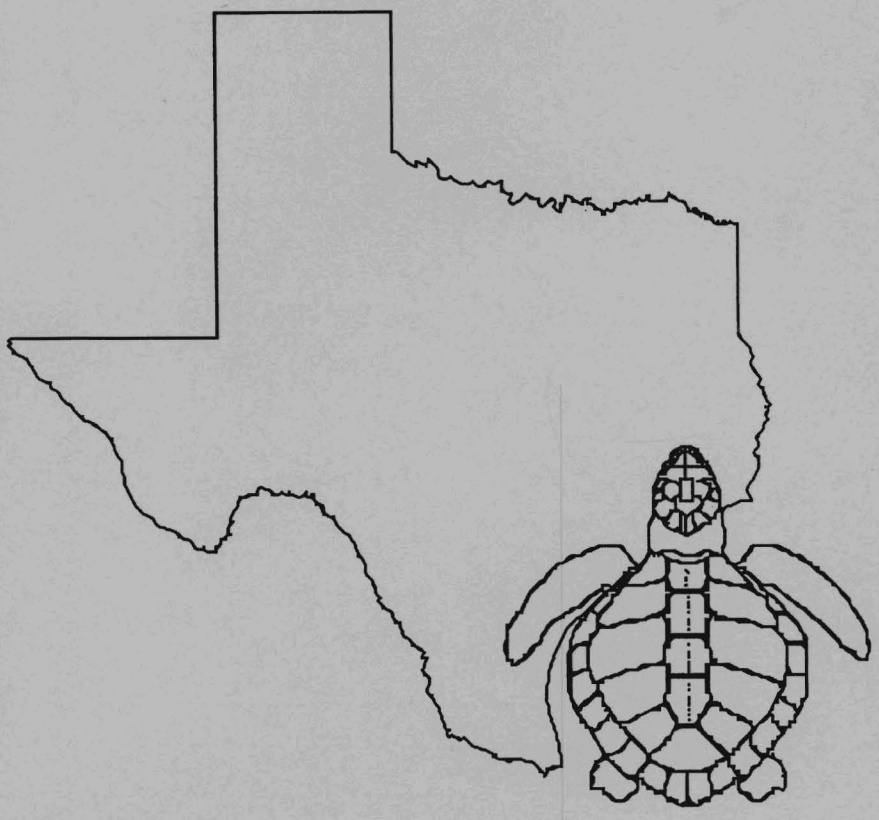

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U.S. DEPARTMENT OF COMMERCE
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The Distribution of Kemp's Ridley Sea Turtles (*Lepidochelys kempi*) Along the Texas Coast: An Atlas

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ABSTRACT

Eight hundred sixty-five records of Kemp's ridley sea turtles (*Lepidochelys kempi*) reported from Texas between the late 1940's to April 1990 were compiled from six data bases and the literature, then plotted on a series of Texas maps. Four categories of Kemp's ridleys are identified throughout the atlas: head-started (turtles that are raised in captivity their first year of life), wild, historical (pre-1980), and nesters. Geographic, seasonal, and size distributions of the turtle categories are plotted by regions. Most Kemp's ridleys were reported from the northeast and central Texas coast. They were reported from both inshore (landward of barrier islands) and offshore (seaward of barrier islands). Scattered nestings occurred in the central to southern regions. Kemp's ridleys were found more often during the spring and summer. A total of 546 turtle records contained measurements; most were 20–59.9 cm curved carapace length and considered sub-adults. Comparison of distributions of head-started and wild Kemp's ridleys suggests head-started Kemp's ridleys inhabit the same areas as wild Kemp's ridleys.

Introduction

The Kemp's ridley sea turtle (*Lepidochelys kempi*) has a unique life history that has been widely discussed by sea turtle biologists (Carr 1955, 1957; Carr and Caldwell 1958; Carr 1961; Hildebrand 1963; Chavez et al. 1968; Pritchard and Marquez 1973). It is an endangered species of sea turtle and has the most restricted breeding range. The primary nesting site for the Kemp's ridley is on the northeastern coast of Mexico, near the village of Rancho Nuevo, Tamaulipas, approximately 322 km (200 mi) south of Brownsville, Texas (Hildebrand 1963). Scattered nestings occur to the south and north of the main nesting beach on the Mexican coast and along the southern and central coastline of Texas (Werler 1951; Carr 1961; Hildebrand 1963, 1980; Pritchard and Marquez 1973; Fuller 1978; Francis 1978; Shaver et al. 1988). There is one record of a Kemp's ridley nesting on the west coast of Florida (Meylan et al. 1990).

Outside the breeding area, the Kemp's ridley range includes other coastal areas of the Gulf of Mexico, the western North Atlantic from Florida to Nova Scotia and the eastern North Atlantic including the British Isles, Netherlands, and France (Bleakney 1965; Brongersma 1972; Pritchard and Marquez 1973; Manzella et al. 1988). Brongersma and Carr (1983) reported one Kemp's ridley from Malta in the Mediterranean, and two have been reported from the Madeira Islands and Western Africa (Brongersma 1972; Fontaine et al. 1989a).

In 1978 an experimental sea turtle head-start conservation project began, involving the U.S. Fish and Wildlife Service, National Park Service, National Marine Fisheries Service (NMFS), and Texas Parks and Wildlife Department, in co-operation with the Instituto Nacional de la Pesca of Mexico. The objective of this project was to increase survival during the first year of life and to establish a nesting colony of Kemp's ridleys on Padre Island National Seashore (PINS), near Corpus Christi, Texas. Annually, 2000 eggs were removed from the natural nesting beach and were incubated in Padre Island sand at PINS. After hatching, the turtles were allowed to crawl down the beach to the water and swim in the surf (Fletcher 1989). This "imprinting" to Padre Island

sand and surf was undertaken in hopes that the turtles would return there to nest when mature. After capturing the hatchlings from the surf they were transferred to NMFS Galveston Laboratory.

In 1988 the practice of "imprinting" was abandoned and hatchlings were transferred to Galveston directly from the nesting beach in Mexico (Fontaine et al. 1990). The turtles were reared in captivity for 9–11 months, then tagged and released into the Gulf of Mexico (Fontaine et al. 1989b). The head-start project is ongoing and as of May 1991, 16,590 head-started Kemp's ridleys have been released. To date, no head-started Kemp's ridley has been positively identified, through the presence of tags, nesting on the beaches of Texas or Mexico.

In 1989 a panel of sea turtle experts reviewed the head-start project and recommended criteria for assessing success of head-starting (Wibbels et al. 1989). Some of the recommended criteria were 1) apparent competence of head-started turtles at and after release (i.e., whether or not head-started turtles survive and grow in the wild, and whether they are comparable to wild ridleys in body weight, feeding behavior, orientation, and reactions), 2) comparison of recovery locations of head-started and wild ridleys.

The present atlas addresses these criteria by comparing and illustrating the geographic, seasonal, and size distributions of head-started and wild Kemp's ridleys found along the Texas coast.

Methods

The atlas' data cover the late 1940's through April 1990 when 865 Kemp's ridley records were compiled from six data bases and literature. The 865 records represent an up- to-date documentation of Kemp's ridley occurrence along the Texas coast. Most records probably resulted from opportunistic events rather than structured sampling schemes. Prior to 1980 and the establishment of the Sea Turtle Stranding and Salvage Network (STSSN), no organized collection of sea turtle information was available. With the STSSN, a more concerted effort was started to document the occurrence of sea turtles along the southeast coast of the United States. But even after 1980, most records probably resulted from opportunistic reports from the general public. Since 1986, as part of the STSSN, systematic surveys to locate stranded sea turtles have been conducted along the Texas coast (Heinly et al. 1988; Duronslet et al. 1991). It is not known, however, whether more stranded sea turtles were documented as a result of these surveys.

Records of 506 turtles were obtained from the STSSN data base maintained at the NMFS Southeast Fisheries Science Center's (SEFSC) Miami Laboratory. Two hundred ninety-eight records were acquired from four data bases maintained at the NMFS SEFSC Galveston Laboratory, including 260 tag return records of head-started turtles and 38 records of either wild Kemp's ridleys caught incidentally to fishing, rehabilitated turtles, or sightings of sea turtles. Four records were acquired from the sea turtle data base at the NMFS Laboratory in Pascagoula, Mississippi, and 57 records, including 13 records of nesting Kemp's ridleys, were acquired from the published literature (Werler 1951; Carr 1961; Hildebrand 1963; Chavez 1967; Molinar 1973; Francis 1978; Fuller 1978; Hildebrand 1980; Rabalais and Rabalais 1980; Fritts and Reynolds 1981; Shaver et al. 1988; Ogren 1989). Only those records positively identifying Kemp's ridleys were used and each record was verified to avoid duplication.

The coast of Texas was divided into 8 regions. Regions were selected for clarity in plotting; however, boundaries of major bay systems were also considered (Fig. 1). From northeast to southwest, the regions consist of the following: region 1—Sabine Pass/High Island Area; region 2—Bolivar Peninsula/Galveston Area; region 3—Freeport/East Matagorda Bay; region 4—Matagorda Bay and Peninsula; region 5—San Antonio Bay/Copano Bay/Matagorda Island; region 6—Corpus Christi Bay/Northern Padre Island; region 7—Central Laguna Madre/Padre Island; region 8—Southern Laguna Madre/Padre Island. Most data fall within the regional boundaries; those occurring outside are shown on maps of the entire Texas coastline and are labeled region 9 on the tables and graphs.

Four categories of Kemp's ridleys are used throughout the atlas. Because there was no data base available for sea turtle records before 1980, two categories of wild turtles are presented. Wild turtles recorded prior to 1980 are classifed as historical records and represented by a circle. The majority of historical records are from the literature. Wild turtles recorded from 1980 to the present are represented by a triangle and the majority of these records were gathered from the STSSN data base. Head-started turtles (turtles reared, tagged, and released as part of the head-start conservation project) are represented by a square. Nesting turtles, identified separately because Texas is the northern extreme of the nesting range, are represented by a diamond.

The plotted symbols represent approximate turtle locations. Latitude and longitude were usually estimated in reports of turtle strandings, tag returns,

sightings, and incidental catches. Each symbol may represent more than one turtle. In some instances, numerous turtles were commonly found in the same area and were assigned the same latitude and longitude. The number of turtles that occur in each region are found in the map legends.

Results

Geographic Distribution

The authors warn the readers that the distribution data comparing numbers of turtles between regions may be biased owing to the fact that the eight regions are not comparable in size or coastal area. However, we believe that, because the regions are based on the boundaries of major bay systems, the information is useful presented in this manner. Information on the distribution of head-started and wild Kemp's ridleys within select bay systems is frequently requested by sea turtle biologists.

Most Kemp's ridleys were reported from regions 1,2, 5, and 6, the northeast and central areas of the coastline (Fig. 2). The frequency of head-started, wild, historical, and nesting Kemp's ridleys is summarized by region in Figure 3. Head-started ridleys were most numerous in regions 2, 5, and 6 (Figs. 5, 8, and 9). Wild Kemp's ridleys were found most frequently in regions 1, 2, and 6 (Figs. 4, 5, and 9). Historical records show wild Kemp's ridleys occurred most frequently in regions 6 and 8 (Figs. 9 and 11), and reports of nestings were concentrated along the central to south Texas coast in regions 6, 7, and 8 (Figs. 9, 10, and 11). Head-started Kemp's ridleys were more frequently reported farther offshore, outside the regional boundaries, than wild Kemp's ridleys (Fig. 12).

Kemp's ridleys were found both offshore (any beach or body of water seaward of barrier islands) and inshore (any beach or body of water landward of barrier islands) with the exception of inshore waters of region 7 (Fig. 10), which includes the central Laguna Madre. Only two historical records documented Kemp's ridleys from the inshore waters of region 8 (Fig. 11), farther south in the Laguna Madre.

A summary by region and recovery method, of head-started, wild, and historical Kemp's ridleys is presented in Table 1. Six hundred and forty (74.0%) of the 865 turtles were found stranded on the beach (dead or alive). One hundred and thirty-nine (16.0 %) were caught incidentally to commercial or recreational fishing and 73 (8.4%) were reported either in power plant intakes, as turtle sightings, captured at the water's surface, or were reported without recovery method. The 13 (1.5%) records of nesting turtles are not summarized in Table 1. Head-started turtles were reported more frequently than wild Kemp's ridley's in shrimp trawls.

Seasonal Distribution

Eight hundred and fifty records were used for the seasonal distribution data. Dates for 15 of the 865 records were unknown. Seasons were defined as the following: winter (January, February, March), spring (April, May, June), summer (July, August, September), and fall (October, November, December). Six hundred and forty-four (75.7%) Kemp's ridleys were reported during the spring and summer (Fig. 13). Seasonal data may be biased, however, owing to an increase in recreational activities along the coast during spring and summer, which may increase the chances of a stranded turtle being found. An increase in recreational and commercial fishing also occurs at this time, and Kemp's ridleys are caught incidentally to these fisheries. Head-started turtles (n=259) were reported most frequently in the spring (52.9%) and summer (31.3%), followed by winter (8.5%) and fall (7.3%) (Fig. 14). Wild Kemp's ridleys (n=544) were reported most frequently in spring (40.3%) and summer (31.2%), followed by fall (18.6%) and winter (9.9%). One turtle nested in winter (late March) while all others (12) nested in spring. Seasonal distribution maps are presented in Figures 15–23.

Most strandings and shrimp trawl catches were reported in spring, whereas most turtles caught by hook and line were reported in summer (Table 2.). Both head-started and wild turtle records followed this pattern.

Size Distribution

Of the 865 Kemp's ridley records, 546 contained measurements. Curved carapace lengths (CCL) were recorded more frequently than straight carapace lengths (SCL); therefore SCL measurements were converted to CCL for size classification. The conversion formula, based on the regression of 144 pairs of SCL and CCL measurements is CCL = 1.06 × SCL (r^2 =0.99, P=0.0001). Three size classes, based on Ogren's (1989) classifications, were used in the data summary: < 20 cm (juveniles), 20–59.9 cm (subadults), and ≥ 60 cm (adults). Four hundred and twelve (75.4%) of the turtles were 20–59.9 cm CCL,

Table 1

Frequency of Kemp's ridleys[a] by region and recovery method. Percentages are based on 865 turtles[b].

	Stranded		Shrimp trawl		Other bycatch[c]		Other[d]	
	#	%	#	%	#	%	#	%
Region 1								
Head-started	11	1.3	8	0.9	7	0.8	6	0.7
Wild	165	19.1	4	0.5	11	1.3	4	0.5
Historical	0	0.0	0	0.0	1	0.1	0	0.0
Total	**176**	**20.4**	**12**	**1.4**	**19**	**2.2**	**10**	**1.2**
Region 2								
Head-started	14	1.6	13	1.5	2	0.2	7	0.8
Wild	111	12.8	4	0.5	6	0.7	4	0.5
Historical	0	0.0	0	0.0	2	0.2	1	0.1
Total	**125**	**14.4**	**17**	**2.0**	**10**	**1.1**	**12**	**1.4**
Region 3								
Head-started	6	0.7	11	1.3	2	0.2	2	0.2
Wild	14	1.6	0	0.0	2	0.2	0	0.0
Historical	0	0.0	0	0.0	1	1.0	2	0.2
Total	**20**	**2.3**	**11**	**1.3**	**5**	**0.5**	**4**	**0.4**
Region 4								
Head-start	5	0.6	12	1.4	3	0.3	5	0.6
Wild	27	3.1	1	0.1	0	0.0	0	0.0
Historical	0	0.0	0	0.0	0	0.0	0	0.0
Total	**32**	**3.7**	**13**	**1.5**	**3**	**0.3**	**5**	**0.6**
Region 5								
Head-started	70	8.1	13	1.5	5	0.6	7	0.8
Wild	18	2.1	3	0.3	1	0.1	2	0.2
Historical	0	0.0	2	0.2	0	0.0	1	0.1
Total	**88**	**10.2**	**18**	**2.0**	**6**	**0.7**	**10**	**1.1**
Region 6								
Head-started	22	2.5	3	0.3	1	0.1	12	1.4
Wild	104	12.0	2	0.2	3	0.3	2	0.2
Historical	16	1.9	1	0.1	0	0.0	0	0.0
Total	**142**	**16.4**	**6**	**0.6**	**4**	**0.4**	**14**	**1.6**
Region 7								
Head-started	0	0.0	0	0.0	1	0.1	0	0.0
Wild	33	3.8	0	0.0	2	0.2	2	0.2
Historical	1	0.1	0	0.0	0	0.0	0	0.0
Total	**34**	**3.9**	**0**	**0.0**	**3**	**0.3**	**2**	**0.2**
Region 8								
Head-started	1	0.1	0	0.0	0	0.0	0	0.0
Wild	13	1.5	0	0.0	1	0.1	2	0.2
Historical	6	0.7	0	0.0	3	0.3	8	0.9
Total	**20**	**2.3**	**0**	**0.0**	**4**	**0.4**	**10**	**1.1**
Region 9								
Head-started	2	0.2	7	0.8	0	0.0	2	0.2
Wild	1	0.1	1	0.1	0	0.0	3	0.3
Historical	0	0.0	0	0.0	0	0.0	1	0.1
Total	**3**	**0.3**	**8**	**0.9**	**0**	**0.0**	**6**	**0.7**
Subtotal								
Head-started	131	15.1	67	7.8	21	2.4	41	4.7
Wild	486	56.2	15	1.7	26	3.0	19	2.2
Historical	23	2.7	3	0.3	7	0.8	13	1.5
Total	**640**	**74.0**	**85**	**9.8**	**54**	**6.2**	**73**	**8.4**

[a] Thirteen nesting turtles, not listed in this table, totaled 1.5% of the 865 turtles.

[b] Due to rounding errors, percentages may not add up to 100%.

[c] "Other bycatch" includes: turtles caught by hook and line and by gill net.

[d] "Other" includes turtles dip-netted or caught by hand while swimming at the surface, turtles found in power plant intakes, sightings of turtles and turtles with no recovery method.

Table 2
Frequency of Kemp's ridleys[a] by season and recovery method. Percentages are based on 850 turtles[b].

	Stranded		Shrimp trawl		Other bycatch[c]		Other[d]	
	#	%	#	%	#	%	#	%
Winter								
Head-started	14	1.6	6	0.7	0	0.0	2	0.2
Wild	52	6.1	2	0.2	0	0.0	0	0.0
Historical	3	0.3	1	0.1	0	0.0	1	0.1
Total	**69**	**8.0**	**9**	**1.0**	**0**	**0.0**	**3**	**0.3**
Spring								
Head-started	83	9.8	27	3.2	8	0.9	19	2.2
Wild	199	23.4	6	0.7	5	0.6	9	1.0
Historical	1	0.1	2	0.2	0	0.0	0	0.0
Total	**283**	**33.3**	**35**	**4.1**	**13**	**1.5**	**28**	**3.2**
Summer								
Head-started	27	3.2	25	2.9	13	1.5	16	1.8
Wild	139	16.3	6	0.7	17	2.0	8	0.9
Historical	8	0.9	0	0.0	3	0.3	11	1.3
Total	**174**	**20.4**	**31**	**3.6**	**33**	**3.8**	**35**	**4.0**
Fall								
Head-started	7	0.8	9	1.0	0	0.0	3	0.3
Wild	96	11.3	1	0.1	2	0.2	2	0.2
Historical	1	0.1	0	0.0	2	0.2	1	0.1
Total	**104**	**12.2**	**10**	**1.1**	**4**	**0.4**	**6**	**0.6**

[a] Thirteen nesting turtles totaled 1.5% of the 850 turtles.
[b] Owing to rounding errors, percentages may not add up to 100%.
[c] "Other bycatch" includes turtles caught by hook and line and by gill net.
[d] "Other" includes turtles dip-netted or caught by hand while swimming at the surface, turtles found in power plant intakes, sightings of turtles, and turtles with no recovery method.

101 (18.5%) ≥ 60 cm, and only 33 (6.1%) < 20 cm (Fig. 24). Wild Kemp's ridleys (n=486) were reported most frequently in the 20–59.9 cm (73.0%)) range, followed by ≥ 60 cm (21.6%) and < 20 cm (5.3%) (Fig. 25). Head-started turtles (n=54) were reported most frequently in the 20–59.9 cm (98.2%), of which 20.3% were > 40 cm CCL. Only 1.8% of head-started turtles were < 20 cm and no head-started turtles were reported ≥ 60 cm. Measurements for nesting turtles were not available. Size distribution maps are presented in Figures 26–34. A summary of head-started, wild, and historical Kemp's ridleys, by size and recovery method, is presented in Table 3.

Discussion

Kemp's ridley sea turtles were found along the entire Texas coast, but most frequently in the northeastern and central regions. The infrequent occurrence of Kemp's ridleys in the inshore habitat of the two southernmost regions of the coast may be attributed to the type of habitat found in the Laguna Madre. This hypersaline area differs from all other Texas estuaries in having clear, shallow waters and a hard sand bottom (Diener 1975). Little or no commercial crab and shrimp fishing exist in this inshore area (Margot Hightower, SEFSC, NMFS, Galveston, TX 77551, pers. commun. May 1991). Large beds of seagrasses and algae are present and green sea turtles (*Chelonia mydas*), which feed on the grasses and algae, are found in the southern reaches of the Laguna Madre. The northern and central Texas estuaries are bordered by tidal marshes and mud flats and have more turbid waters (Diener 1975). They support commercial fisheries for crab and shrimp (Margot Hightower, SEFSC, NMFS, Galveston, TX 77551, pers comm. May 1991).

Fishes, crabs, and the gastropod scavenger *Nassarius* were the most frequently identified food items in the stomachs of 49 Kemp's ridleys that were found stranded along the northern Texas coast between 1986 and 1989 (Stanley, in prep.). Similar results were reported by Owens (1986) based on the examination of stomachs from 77 Kemp's ridleys (including 47 head-started turtles) stranded along the central Texas coast. Owens suggested that turtles feed on trawler bycatch, because of the presence of fish

Table 3

Frequency of Kemp's ridleys[a] by size and recovery method. Percentages are based on 546 turtles[b].

	Stranded		Shrimp trawl		Other bycatch[c]		Other[d]	
	#	%	#	%	#	%	#	%
<20 cm								
Head-started	1	0.2	0	0.0	0	0.0	0	0.0
Wild	24	4.4	2	0.4	0	0.0	0	0.0
Historical	1	0.2	0	0.0	3	0.6	0	0.0
Total	**26**	**4.8**	**2**	**0.4**	**3**	**0.6**	**0**	**0.0**
20–59.9 cm								
Head-started	38	7.0	7	1.3	7	1.3	1	0.2
Wild	325	59.5	7	5.7	21	3.9	2	0.4
Historical	0	0.0	0	0.0	2	0.4	0	0.0
Total	**363**	**66.5**	**14**	**2.5**	**30**	**5.7**	**3**	**0.6**
≥60 cm								
Head-started	0	0.0	0	0.0	0	0.0	0	0.0
Wild	104	19.0	1	0.2	0	0.0	0	0.0
Historical	0	0.0	0	0.0	0	0.0	0	0.0
Total	**104**	**19.0**	**1**	**0.2**	**0**	**0.0**	**0**	**0.0**

[a] No measurements were recorded for the thirteen nesting turtles.
[b] Owing to rounding errors, percentages may not add up to 100%.
[c] "Other bycatch" includes turtles caught by hook and line and by gill net.
[d] "Other" includes turtles dip-netted or caught by hand while swimming at the surface, turtles found in power plant intakes, sightings of turtles, and turtles with no recovery method.

(which turtles could not normally catch) and the gastropod scavenger *Nassarius* (an indicator that the food was dead when it was eaten) in the gut contents of stranded turtles. The fishes and crabs favored by the Kemp's ridleys are more plentiful in the northeastern and central estuaries of Texas. Therefore, these areas seem to be a more suitable habitat than the southern areas.

Head-started and wild Kemp's ridleys were found in the same areas. Both head-started and wild Kemp's ridleys were most numerous in regions 2 and 6, the Bolivar/Galveston area and the Corpus Christi/North Padre Island area. Region 6 was the primary release area (Fig. 1) for most head-started Kemp's ridleys (Fontaine et al. 1990). A high number of head-started turtles were reported from region 5 which includes Copano Bay, a head-start release site in 1985 (Manzella et al. 1988). Wild Kemp's ridleys were also numerous in region 1, the Sabine Pass/High Island area. Region 1 was the fourth most numerous region for head-started turtles. This area is considered a major feeding ground for Kemp's ridleys (Ogren 1989). Only two head-started Kemp's ridleys were reported from regions 7 and 8, the southern areas of the coast. Wild Kemp's ridleys were also infrequently reported from these regions.

Head-started turtles were more frequently reported farther offshore and in shrimp trawls than wild Kemp's ridleys. This may be due to the fact that head-started turtles bear a tag, which may prompt the public to report the turtles more readily than untagged turtles.

Both head-started and wild Kemp's ridleys were more frequently reported in the spring and summer.

Head-started and wild Kemp's ridleys occurred more frequently in the 20–59.9 cm CCL size class and could be considered sub-adults (Ogren 1989). The average size of head-started turtles at release was 16–18 cm SCL. Most tag returns of head-started turtles, reported with measurements, occurred in the 20–59.9 cm CCL range (n=53) and 21% were > 40 cm. These measurements suggest these turtles do adapt and grow, after release into their natural habitat. Apparently the most common size class of ridleys found in the Gulf of Mexico is 20–59.9 cm. (Ogren 1989; Schmid and Ogren 1990).

The present atlas illustrates the distribution of head-started and wild Kemp's ridleys along the Texas coast. The head-started turtles do seem to adapt to the wild and are found in the same areas as wild Kemp's ridleys. Tag returns of head-started turtles found in other areas of the Gulf of Mexico and the Atlantic coast of the United States (n=425), also sug-

gest that these turtles adapt to the wild after release and are found in the same areas as wild Kemp's ridleys (Manzella et al. 1988; Fontaine et al.1989a). Similar atlases showing the distribution of known records of Kemp's ridleys throughout their entire range would be useful to sea turtle biologists, conservationists, and agencies responsible for protection and management of this endangered species.

Acknowledgments

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Citations

Bleakney, S.
1965. Reports of marine turtles from New England and eastern Canada. The Canadian Field Naturalist 79:120–128.

Brongersma, L. D.
1972. European Atlantic turtles. Zoologische Verhandelingen 121:318 p., 12 plt., 8 maps.

Brongersma, L. D., and A. F. Carr
1983. *Lepidochelys kempi* (Garman) from Malta. Proceedings of the Koninklijke Nederlandse Akademie, Serie C, 86(4):445–454.

Carr, A.
1955. The riddle of the ridley. Animal Kingdom 58(5): 146–156.
1957. Notes on the zoogeography of the Atlantic sea turtles of the genus *Lepidochelys*. Revista De Biologica Tropical 5(1):45–61.
1961. The ridley mystery today. Animal Kingdom 64(1):7–12.

Carr, A., and D. K. Caldwell
1958. The problem of the Atlantic ridley turtle (*Lepidochelys kempi*) in 1958. Revista Biologica Tropical 6(2):245–262.

Chavez, H. M.
1967. Nota preliminar sobre la recaptura de ejemplares marcados de tortuga lora, *Lepidochelys olivacea kempii*. Boletin del Programa Nacional de Marcado de Tortugas Marinas 1(6): 373–377.

Chavez, H. M., M. Contreras G., and T. P. E. Hernandez D.
1968. On the coast of Tamaulipas (Part One). International Turtle & Tortoise Society Journal 2(4):20–29, 37.
1968. On the coast of Tamaulipas (Part Two). International Turtle & Tortoise Society Journal 2(5):16-19, 27–34.

Diener, R. A.
1975. Cooperative Gulf of Mexico estuarine inventory and study—Texas: area description. NOAA Technical Report NMFS CIRC - 393, 129 p.

Duronslet, M. J., D. B. Revera, and K. M. Stanley.
1991. Marine debris and sea turtle strandings on beaches of the upper Texas and southwestern Louisiania coasts, June 1987 through September 1989. NOAA Technical Memorandum NMFS-SEFC-279, 47 p.

Fletcher, M. R.
1989. The National Park Service's role in the introduction of Kemp's ridley sea turtle. *In* Proceedings of the first international symposium on Kemp's ridley sea turtle biology, conservation and management (C. W. Caillouet Jr. and A. M. Landry Jr., eds.), p. 7–9. Texas A&M University, Sea Grant College Program, TAMU-SG-89- 105.

Fontaine, C. T., S. A. Manzella, T. D. Williams, R. M. Harris, and W. J. Browning.
1989a. Distribution, growth and survival of head started, tagged and released Kemp's ridley sea turtles (*Lepidochelys kempi*) from year-classes 1978–1983. *In* Proceedings of the first international symposium on Kemp's ridley sea turtle biology, conservation and management (C. W. Caillouet Jr. and A. M. Landry Jr., eds.), p. 124–144. Texas A&M University, Sea Grant College Program, TAMU-SG-89-105.

Fontaine, C. T., T. D. Williams, S. A. Manzella, and C. W. Caillouet Jr.
1989b. Kemp's ridley sea turtle head start operations of the NMFS SEFC Galveston Laboratory. *In* Proceedings of the first international symposium on Kemp's ridley sea turtle biology, conservation and management (C. W. Caillouet Jr. and A. M. Landry Jr., eds.), p. 96–110. Texas A&M University, Sea Grant College Program, TAMU-SG-89-105.

Fontaine, C. T., M. J. Duronslet, D. B. Revera, T. D. Williams, J. A.Williams, S. A. Manzella, E. K. Stabenau, A. M. Landry Jr., and C. W. Caillouet Jr.
1990. Kemp's ridley head start experiment and other sea turtle research at the Galveston Laboratory: annual report - fiscal year 1989. NOAA Technical Memorandum NMFS-SEFC-266, iv plus 28 p.

Francis, K.
1978. Kemp's ridley sea turtle conservation programs at South Padre Island, Texas and Rancho Nuevo, Tamaulipas, Mexico. Florida Marine Research Publications 33:51–52.

Fritts, T. H., and R. P. Reynolds.
1981. Pilot study of the marine mammals, birds and turtles in OCS areas of the Gulf of Mexico. U. S. Fish and Wildlife Service, Office of Biological Services, Washington, D. C. FWS/OBS - 81/36, 139 p.

Fuller, D. A.
1978. The habitats, distribution, and incidental capture of sea turtles in the Gulf of Mexico. Louisiana State University, Baton Rouge, LA, LSU-CFI-85-31, 44 p.

Heinly, R. W., E. K. Stabenau, A. M. Landry Jr., and M. Duronslet.
1988. Mutilation of stranded sea turtles along the Texas coast, p. 33–34. *In* Proceedings of the eighth annual workshop on sea turtle conservation and biology (B. A. Schroeder, compiler). NOAA Technical Memorandum NMFS-SEFC-214, iii plus 135 p.

Hildebrand, H. H.
1963. Hallazgo del area de anidacion de la tortuga marina "lora", *Lepidochelys kempi* (Garman), en la costa occidental del Golfo de Mexico. Sobretiro de Ciencia 22(4):105–112.
1980. Kemp's ridley or tortuga lora, *Lepidochelys kempi* (Garman). Unpublished report to Southeast Fisheries Center, NMFS, 6 p.

Manzella, S. A., C. W. Caillouet Jr., and C. T. Fontaine.
1988. Kemp's ridley, *Lepidochelys kempi*, sea turtle head start tag recoveries: distribution, habitat, and method of recovery. Marine Fisheries Review 50(3):24–32.

Meylan, A., P. Castaneda, C. Coogan, T. Lozon, and J. Fletemeyer.
1990. First recorded nesting by Kemp's ridley in Florida, USA. Marine Turtle Newsletter 48:8–9.

Molinar, T. P. E. Vargas.
1973. Resultados preliminares del marcado de tortugas marinas en aguas Mexicanas (1966–1977). Instituto Nacional de Pesca/Serie Informativa (INP/SI): i12, 27 p.

Ogren, L. H.
1989. Distribution of juvenile and sub-adult Kemp's ridley turtles: preliminary results from the 1984–1987 surveys. *In* Proceedings of the first international symposium on Kemp's ridley sea turtle biology, conservation and management (C. W. Caillouet Jr. and A. M. Landry Jr., eds.), p. 116–123. Texas A&M University, Sea Grant College Program, TAMU-SG-89-105, vi plus 260 p.

Owens, D.
1986. Recent *L. kempi* necropsy results from Texas. Unpublished report to Kemp's ridley recovery team, 4 August 1986, 40 p.

Pritchard, P. C. H., and R. Marquez M.
1973. Kemp's ridley turtle or Atlantic ridley. International Union for Conservation of Nature and Natural Resources (IUCN) Monograph No. 2: Marine Turtle Series, 30 p.

Rabalais, S. C., and N. N. Rabalais.
1980. The occurrence of sea turtles on the south Texas coast. Contributions in Marine Science 23:123–129.

Schmid, J. R., and L. H. Ogren.
1990. Results of a tagging study at Cedar Key, Florida, with comments on Kemp's ridley distribution in the southeastern U. S. *In* Proceedings of the tenth annual workshop on sea turtle biology and conservation (T. H. Richardson, J. I. Richardson, and M. Donnely, compilers), p. 129–130. NOAA Technical Memorandum NMFS-SEFC-278.

Shaver, D. J., E. Cheeseman, and J. Bjork.
1988. National Parks Service, Padre Island National Seashore. Action plan for nesting sea turtles, nests and hatchlings on Texas beaches from Matagorda Island southward. Unpublished report, 39 p.

Stanley, K.
In prep. Feeding ecology of the Loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempi*) sea turtles in the Northwestern Gulf of Mexico. M.S. thesis, Texas A&M University at Galveston. Galveston, Texas.

Werler, J. E.
1951. Miscellaneous notes on the eggs and young of Texan and Mexican reptiles. Zoologica 36(3).

Wibbels, T., N. Frazer, M. Grassman, J. Hendrickson, and P. Pritchard.
1989. Blue ribbon panel review of the National Marine Fisheries Service Kemp's ridley headstart program. Report submitted to the Southeast Regional Office, National Marine Fisheries Service, August 1989, i plus 11 p.

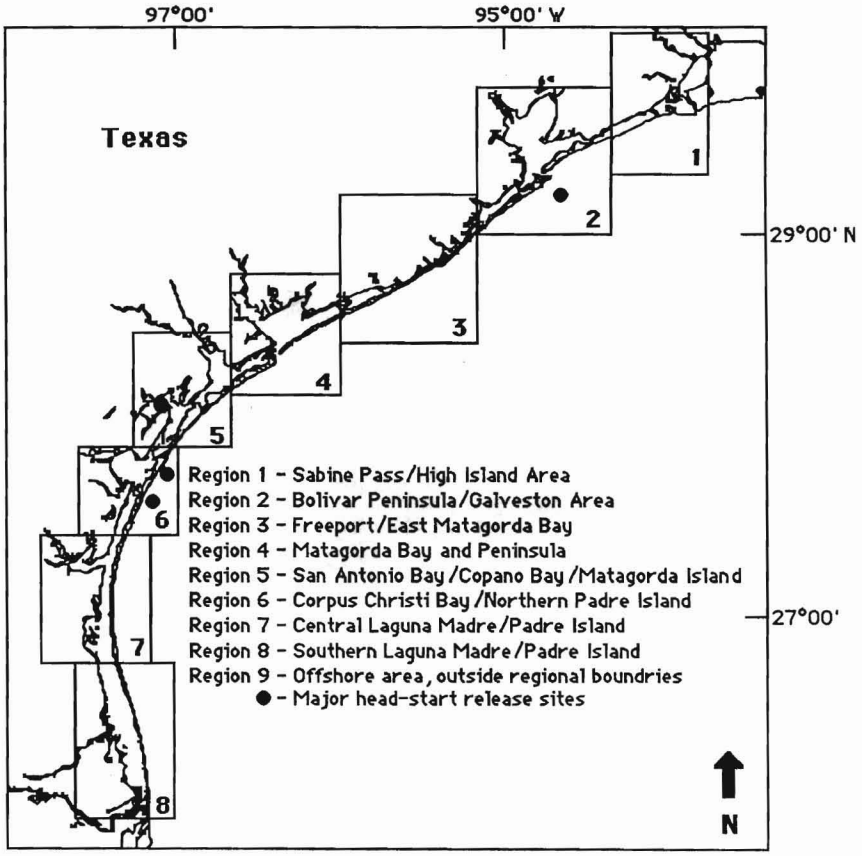


Figure 1
The Texas coast divided into eight regions. The offshore area, outside the regional boundaries, is region 9. Major release sites of headstarted turtles are also shown.

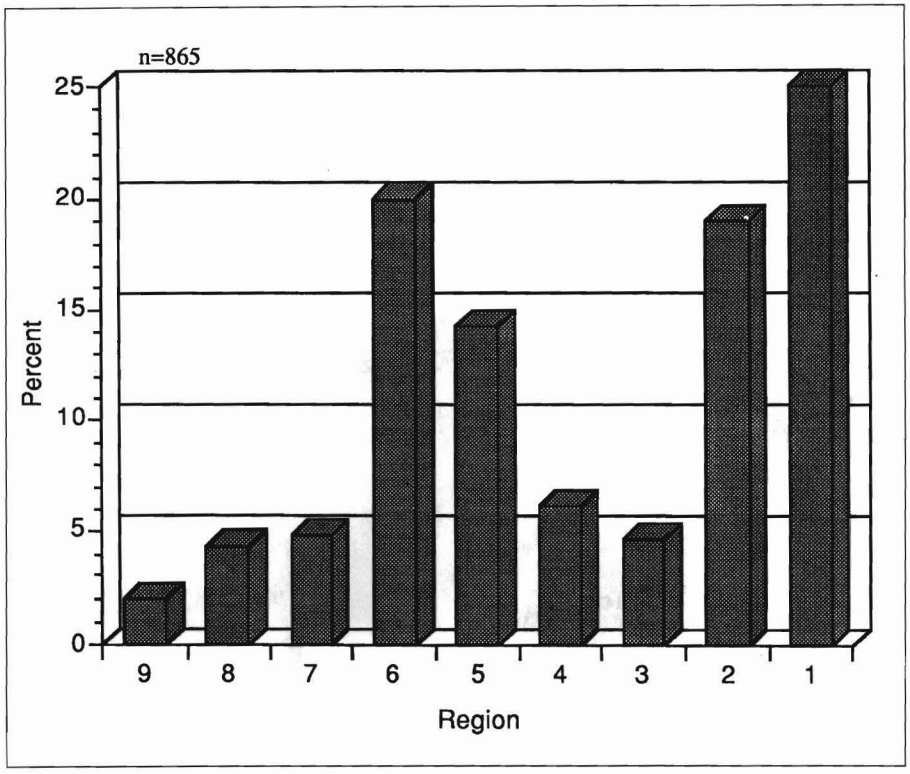


Figure 2
Frequency distribution of Kemp's ridleys found along the Texas coast.

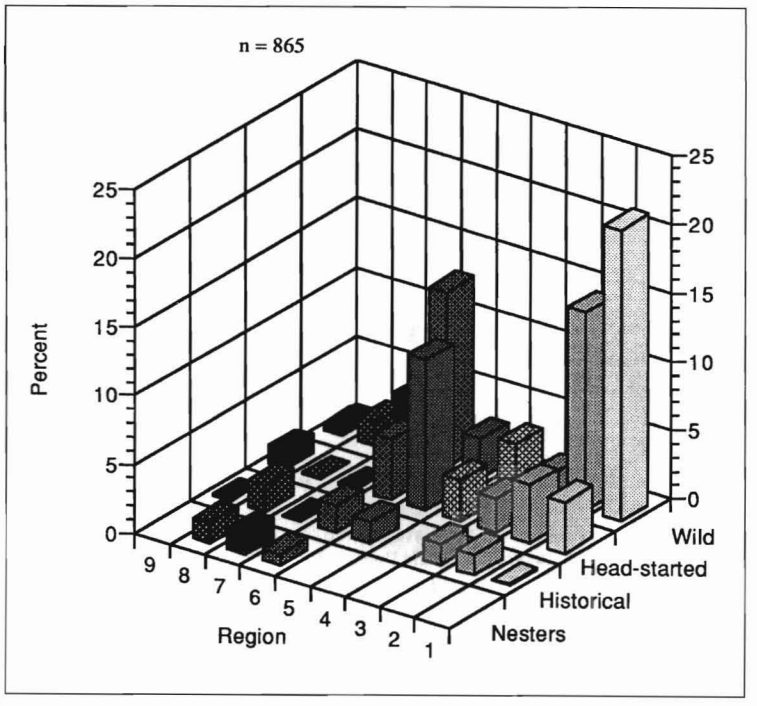


Figure 3
Frequency distribution of Kemp's ridley groups, by region.

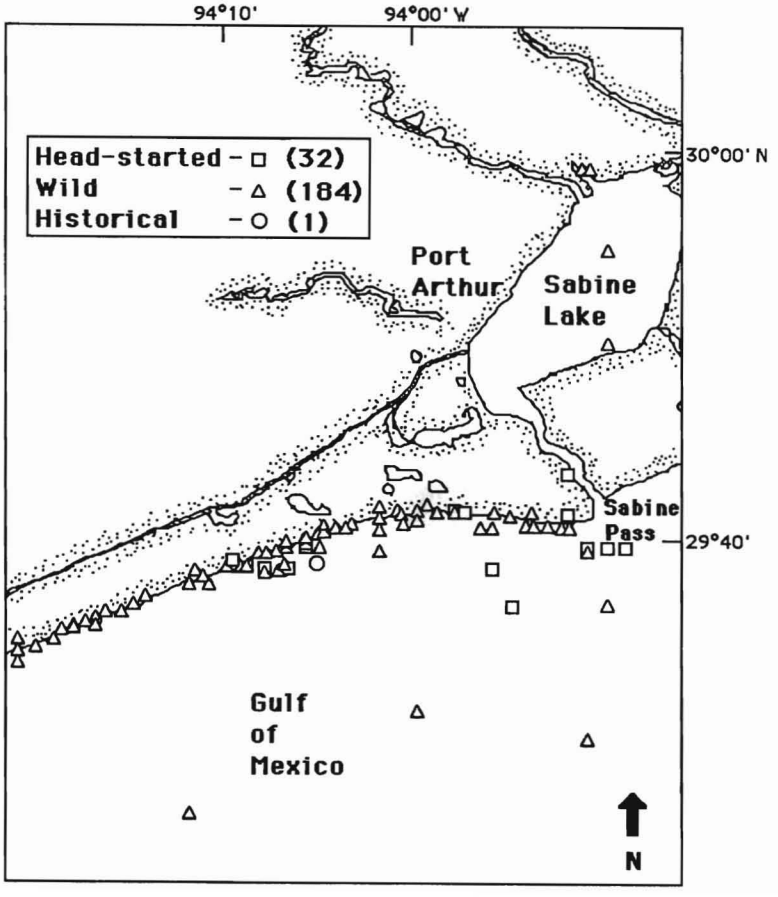


Figure 4
Geographic distribution of Kemp's ridleys in region 1 - Sabine Pass/High Island area.

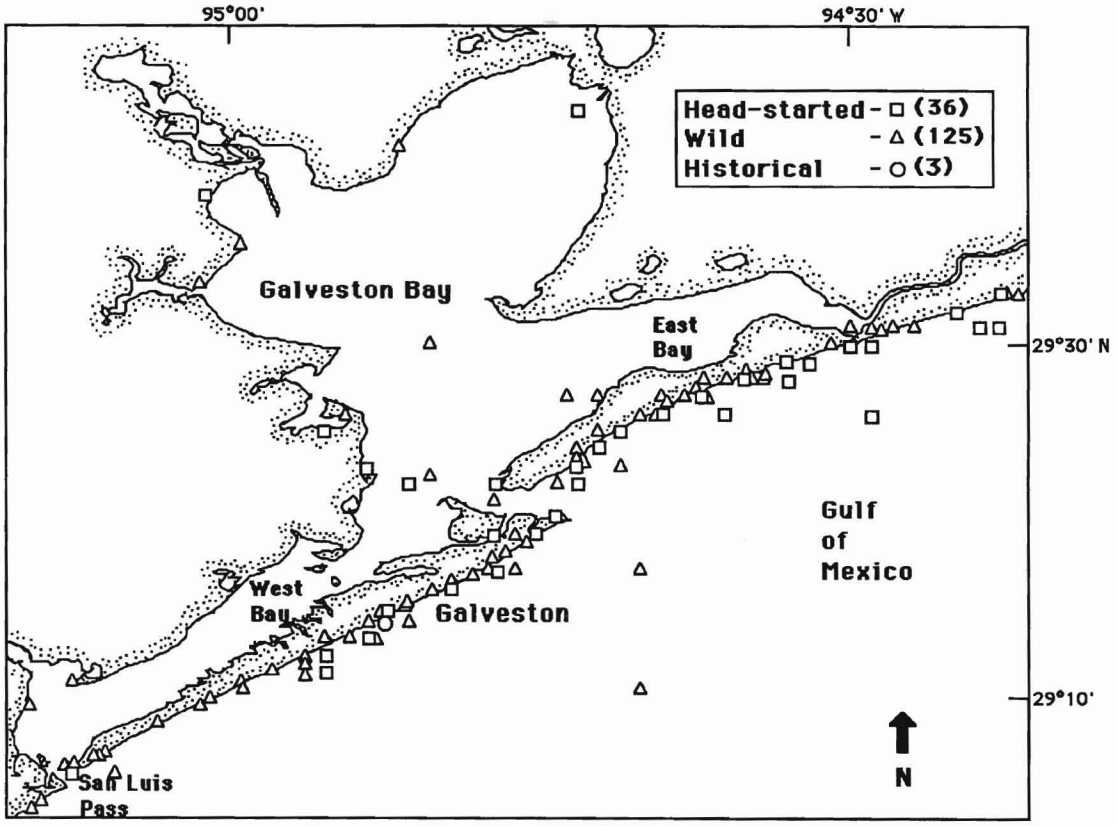


Figure 5
Geographic distribution of Kemp's ridleys in region 2 - Bolivar Peninsula/ Galveston area.

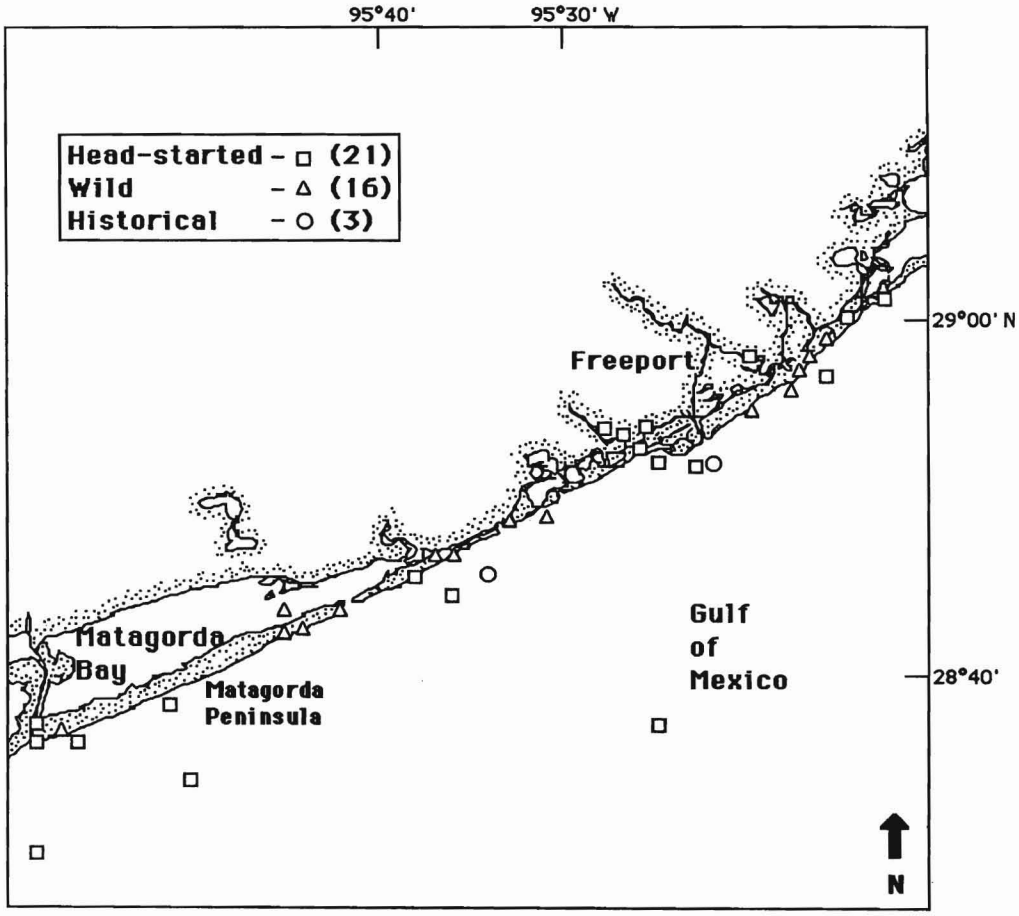


Figure 6
Geographic distribution of Kemp's ridleys in region 3 - Freeport/East Matagorda Bay.

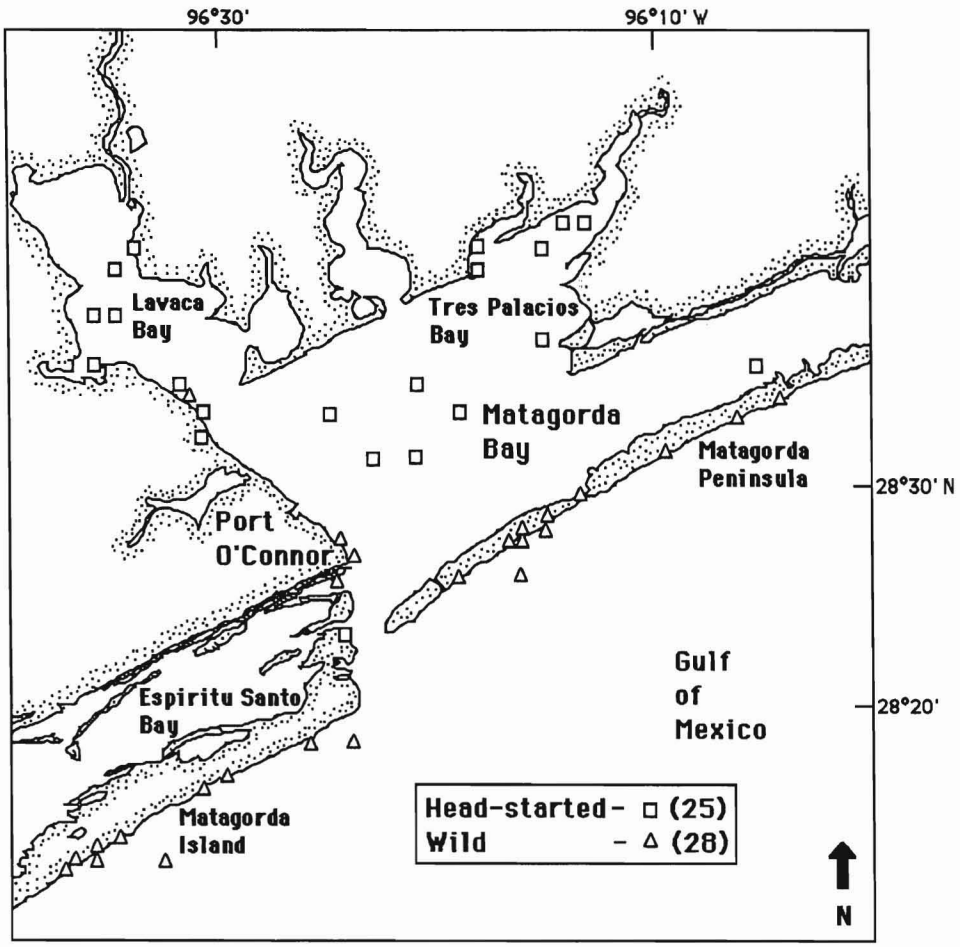


Figure 7
Geographic distribution of Kemp's ridleys in region 4 - Matagorda Bay and Peninsula.

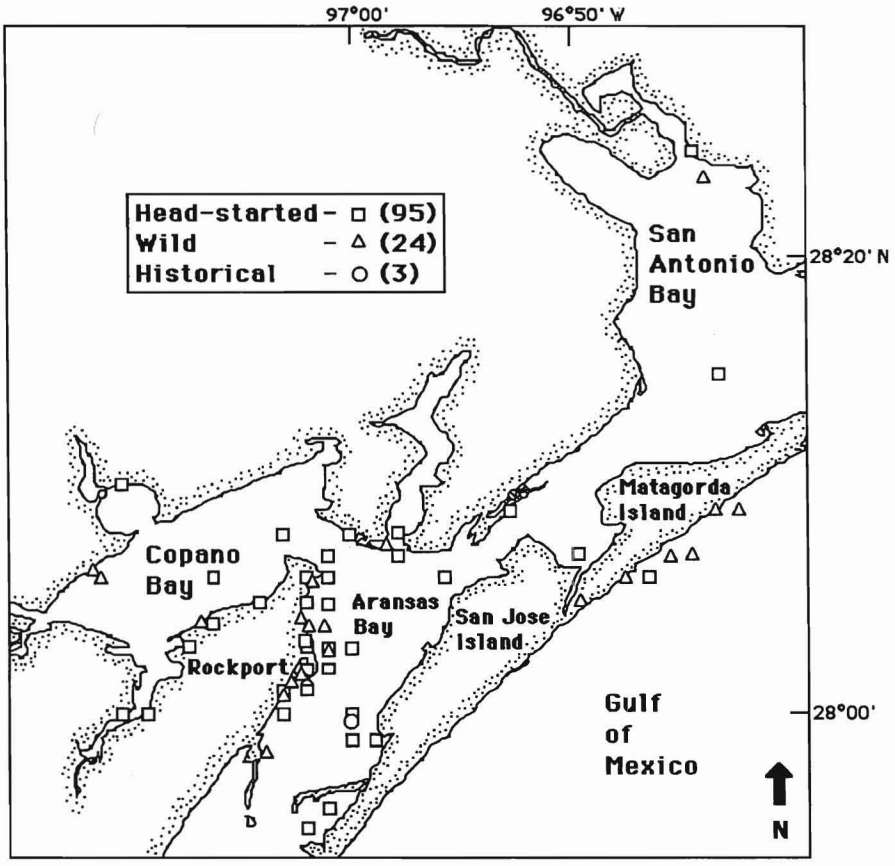


Figure 8
Geographic distribution of Kemp's ridleys in region 5 - San Antonio Bay/ Copano Bay/Matagorda Island.

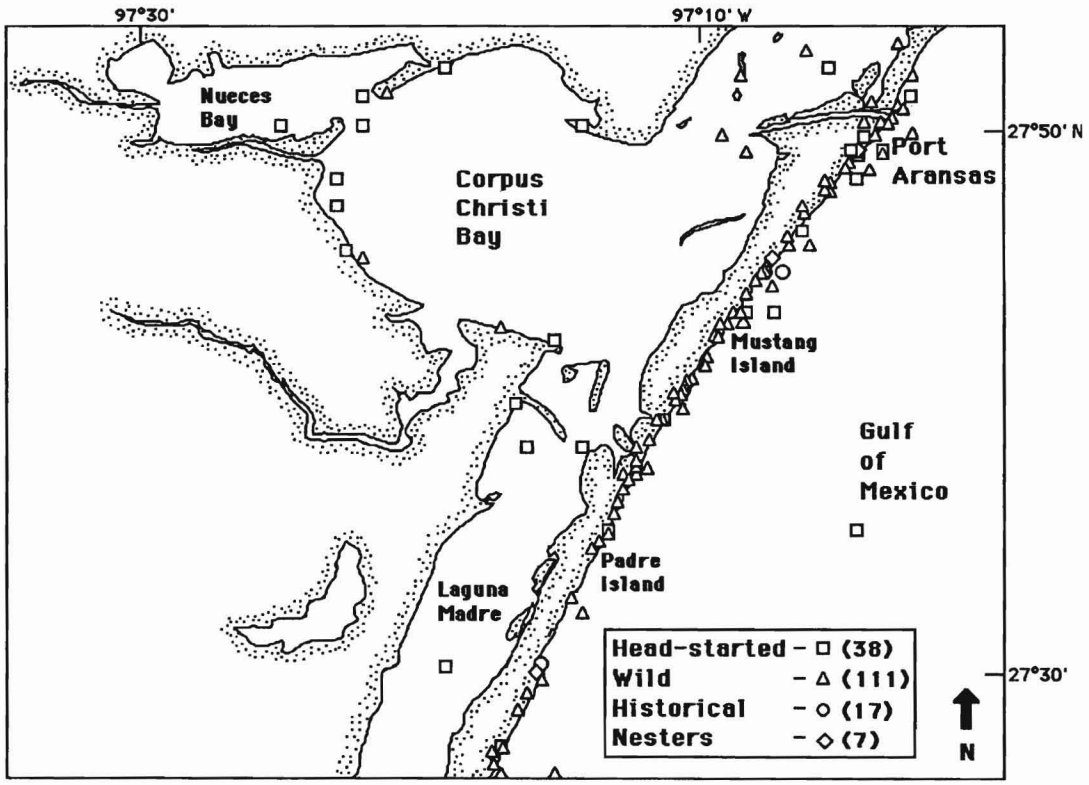


Figure 9
Geographic distribution of Kemp's ridleys in region 6 - Corpus Christi Bay/Northern Padre Island.

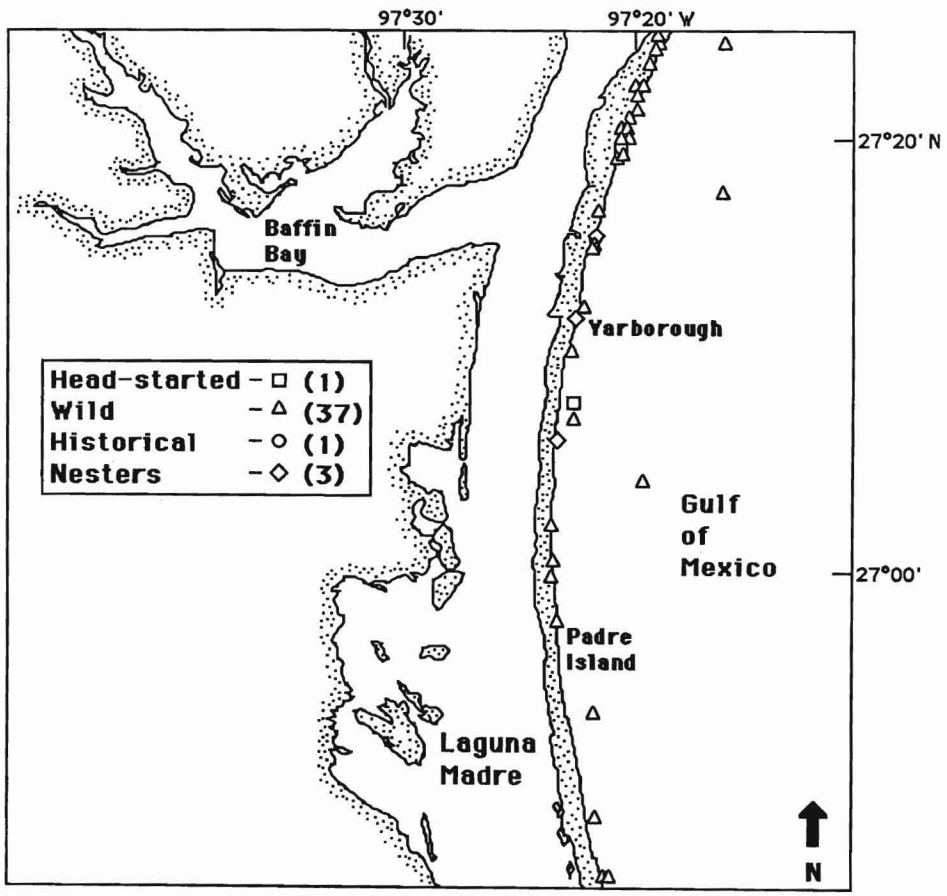


Figure 10
Geographic distribution of Kemp's ridleys in region 7 - Central Laguna Madre/Padre Island.

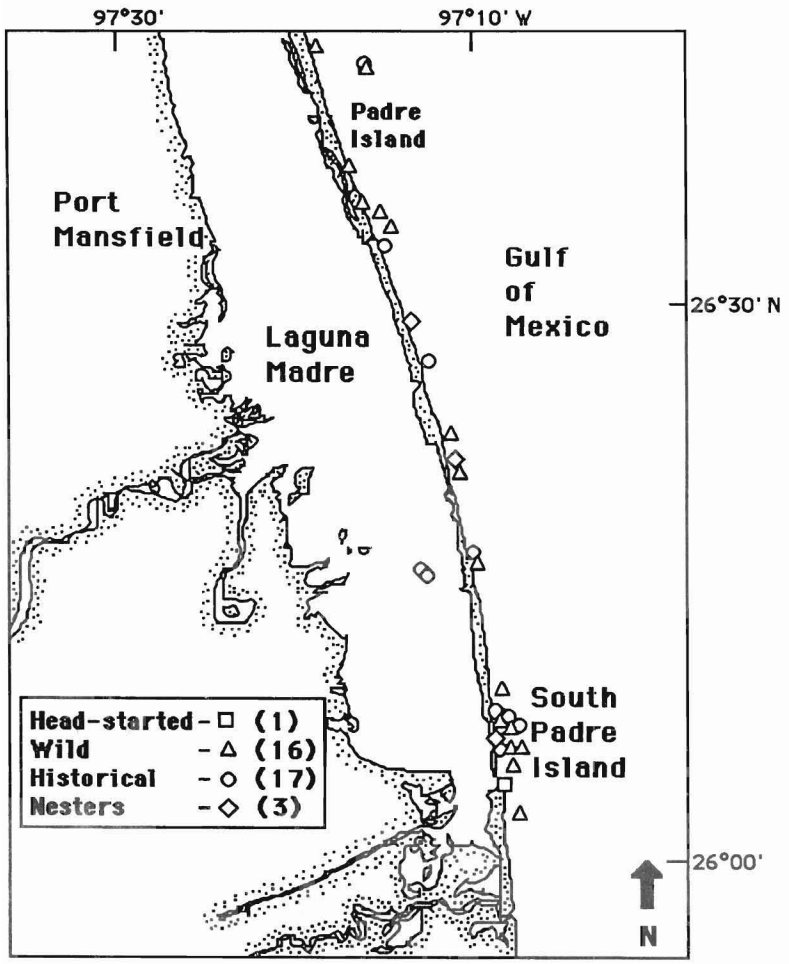


Figure 11
Geographic distribution of Kemp's ridleys in region 8 - Southern Laguna Madre/Padre Island.

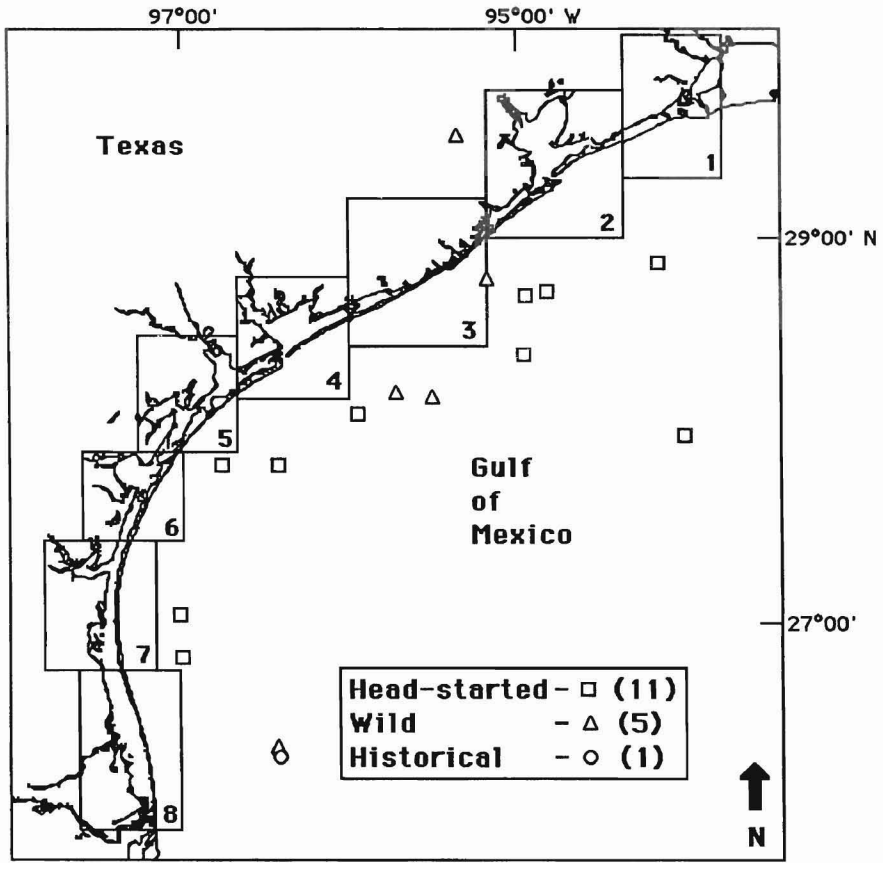


Figure 12
Geographic distribution of Kemp's ridleys outside the regional boundaries. The wild turtle positioned on land near region 2 was found in a drainage ditch in Houston, TX.

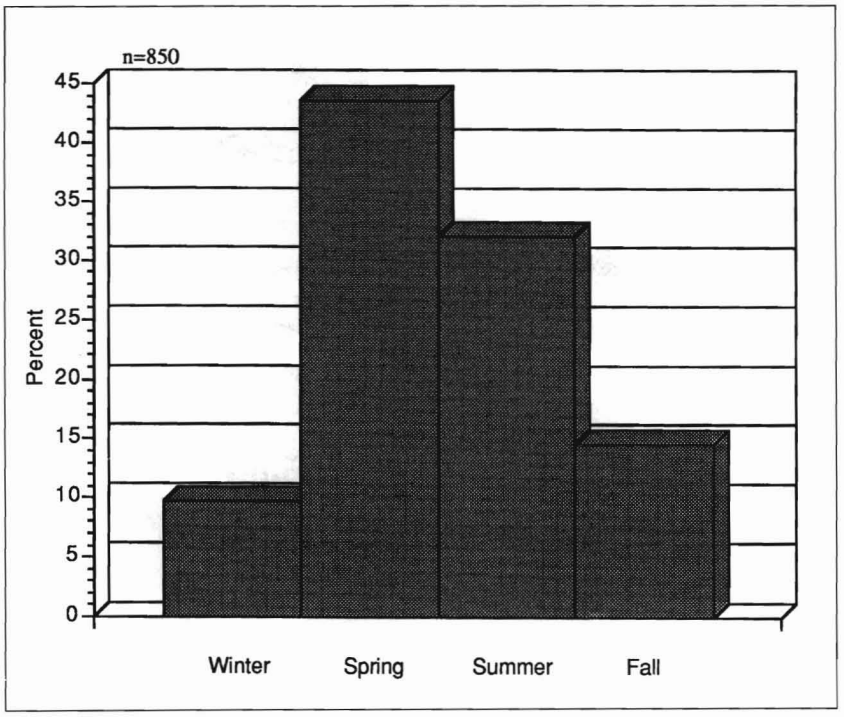


Figure 13
Frequency distribution of Kemp's ridleys, by season.

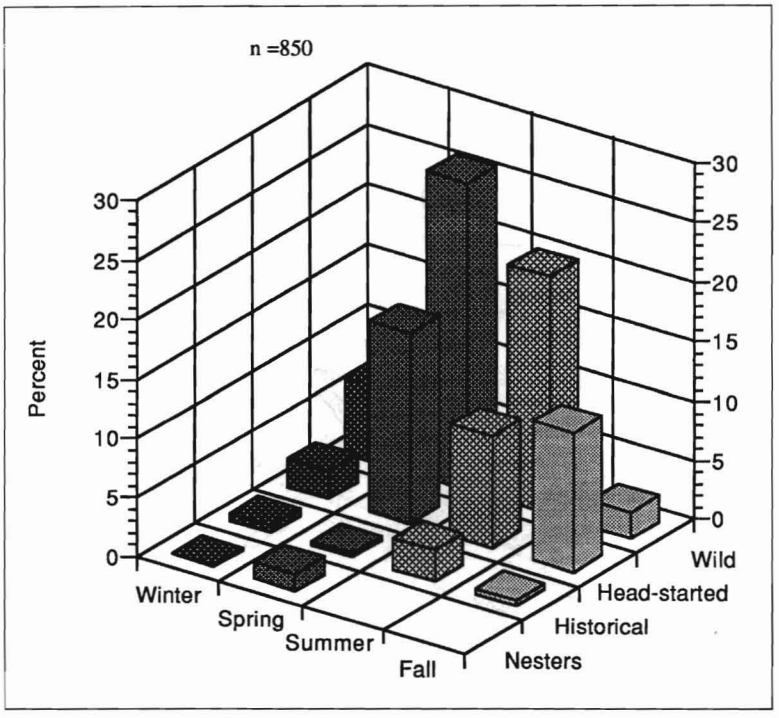
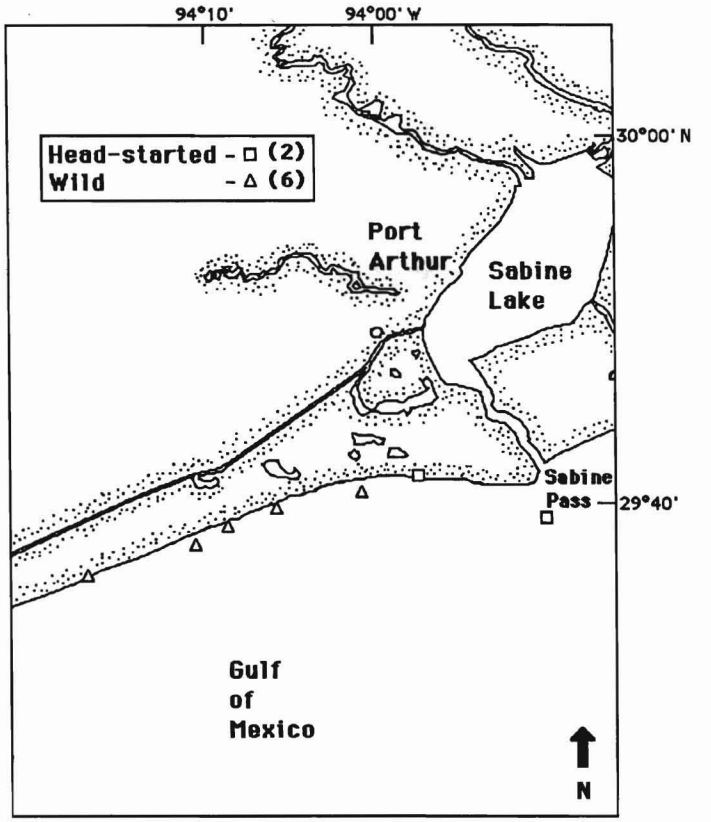
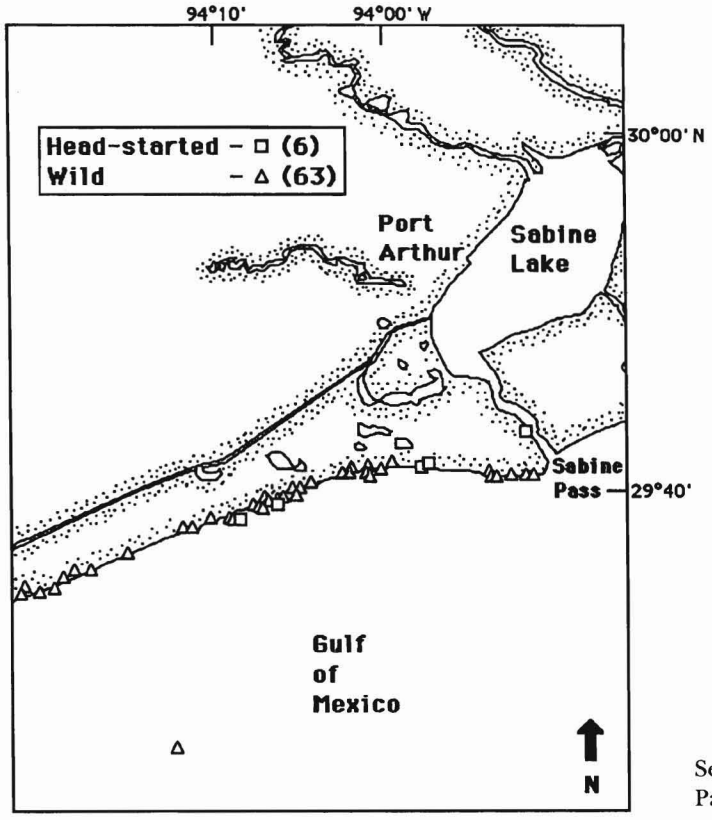


Figure 14
Frequency distribution of Kemp's ridley groups, by season.

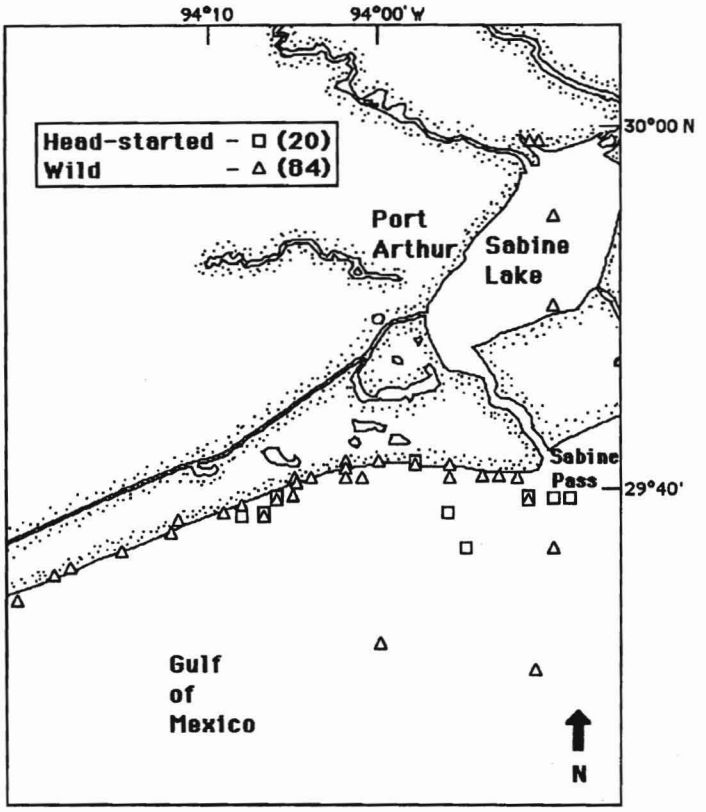


Winter

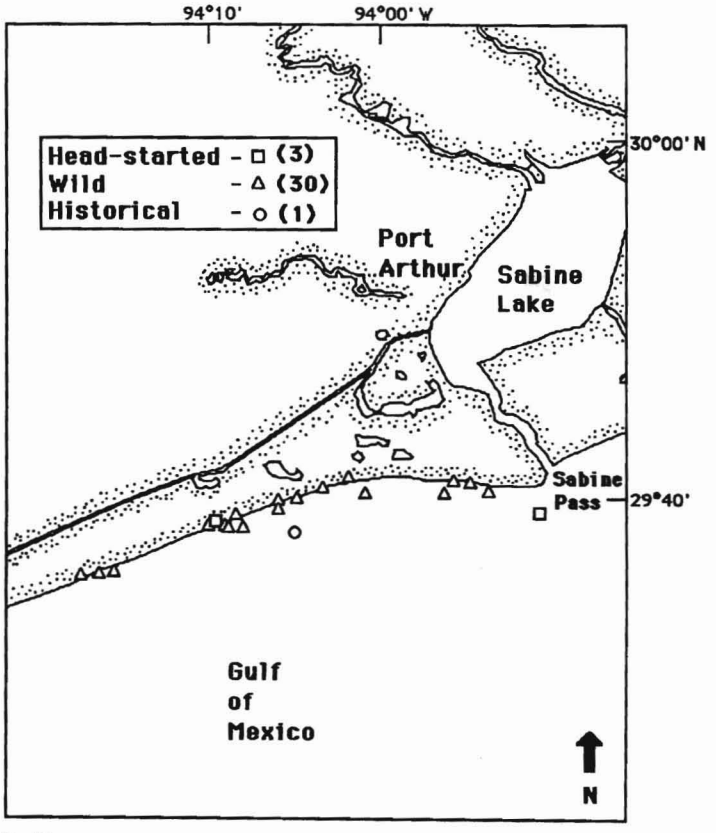


Spring

Figure 15
Seasonal distribution of Kemp's ridleys in region 1 - Sabine Pass/High Island area.

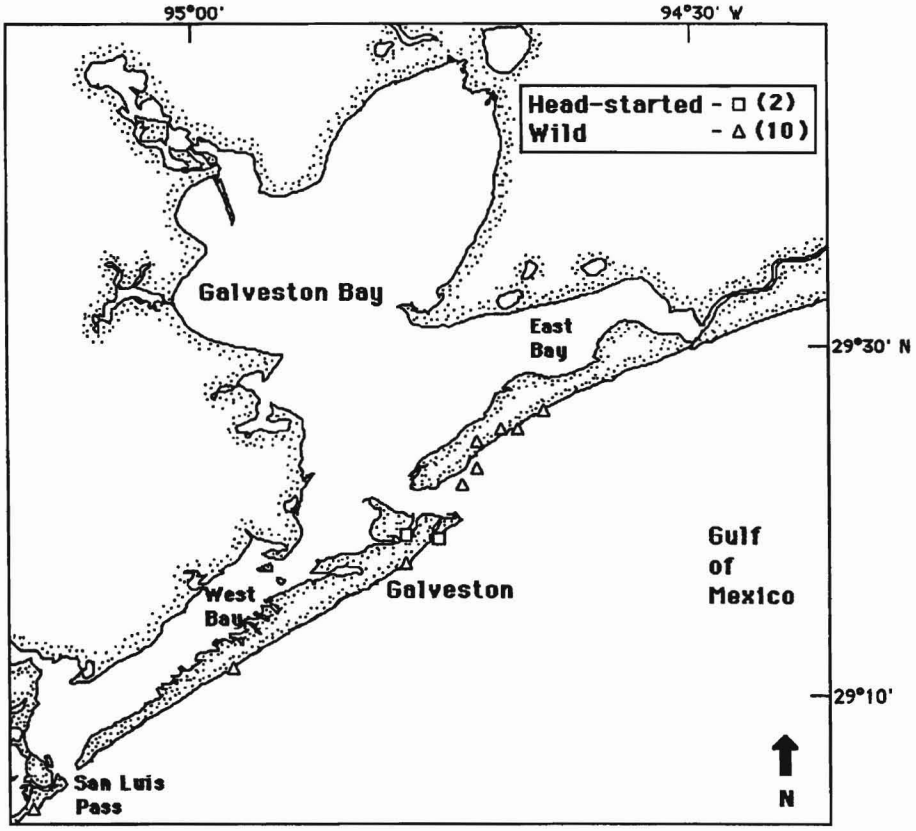


Summer



Fall

Figure 15 (continued)



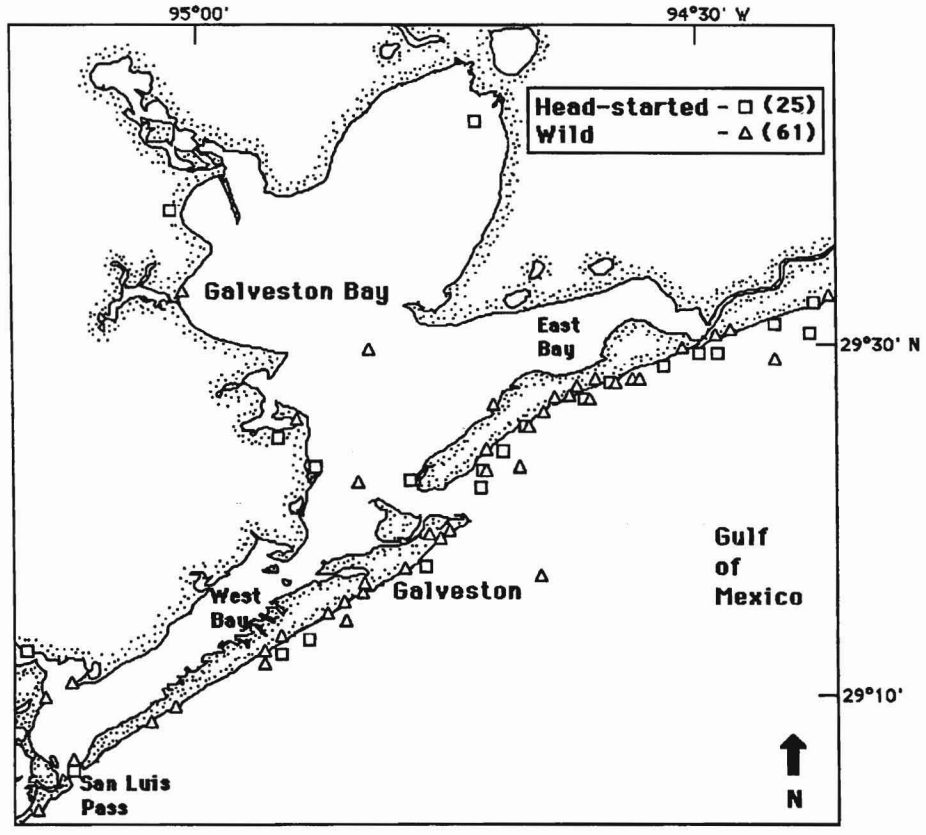
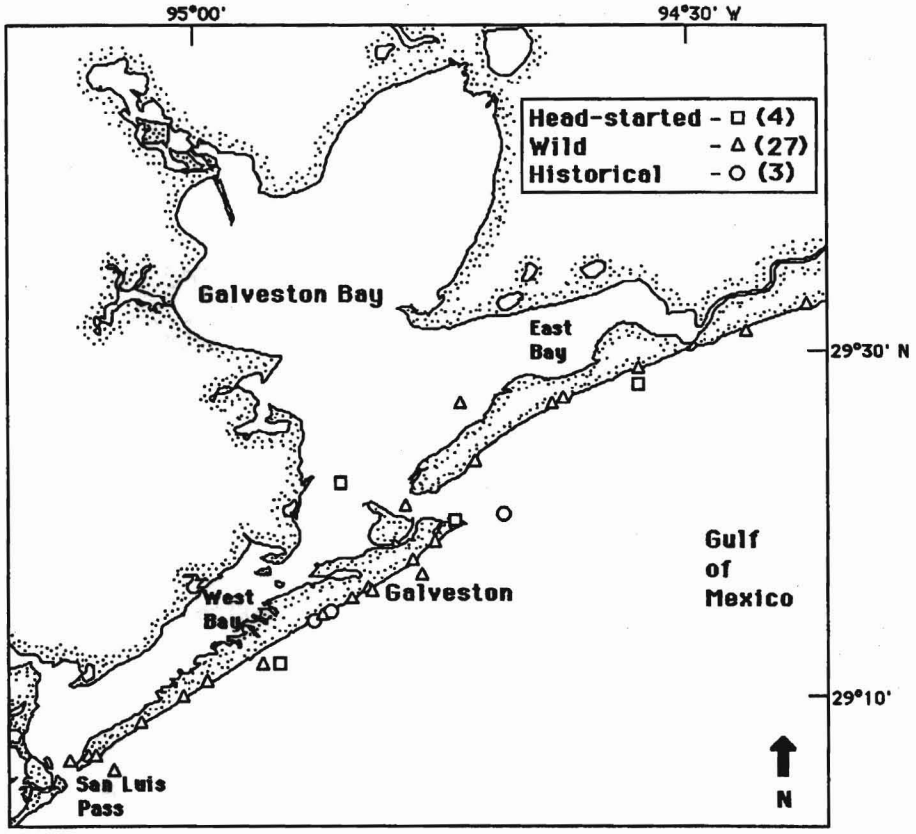
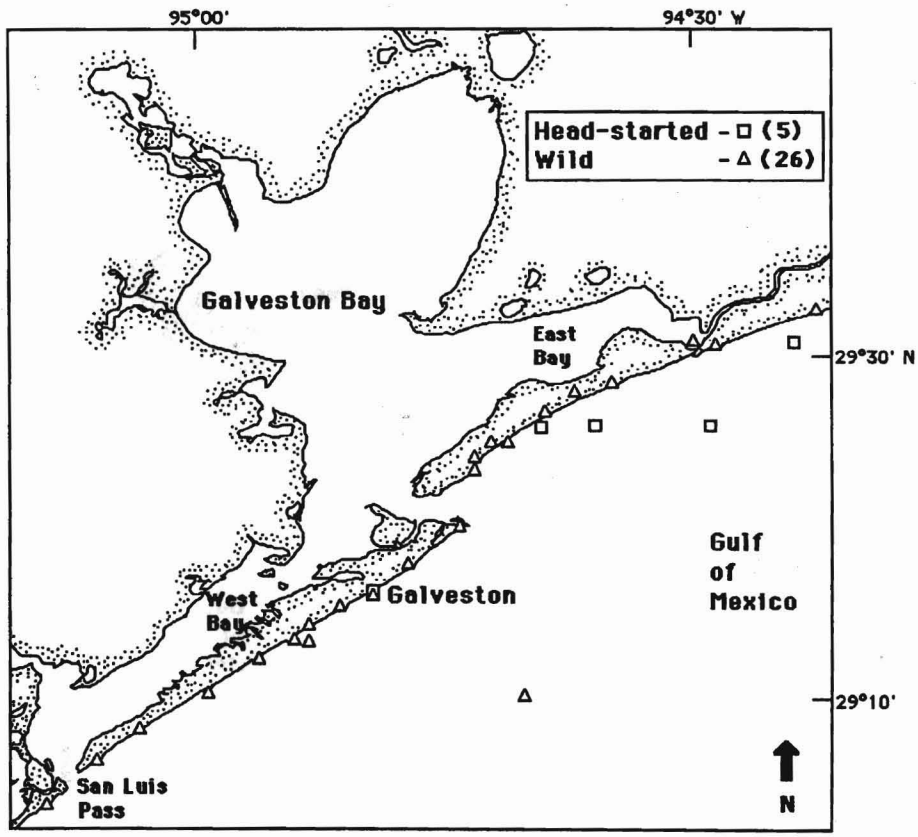


Figure 16
Seasonal distribution of Kemp's ridleys in region 2 - Bolivar Peninsula/ Galveston area.

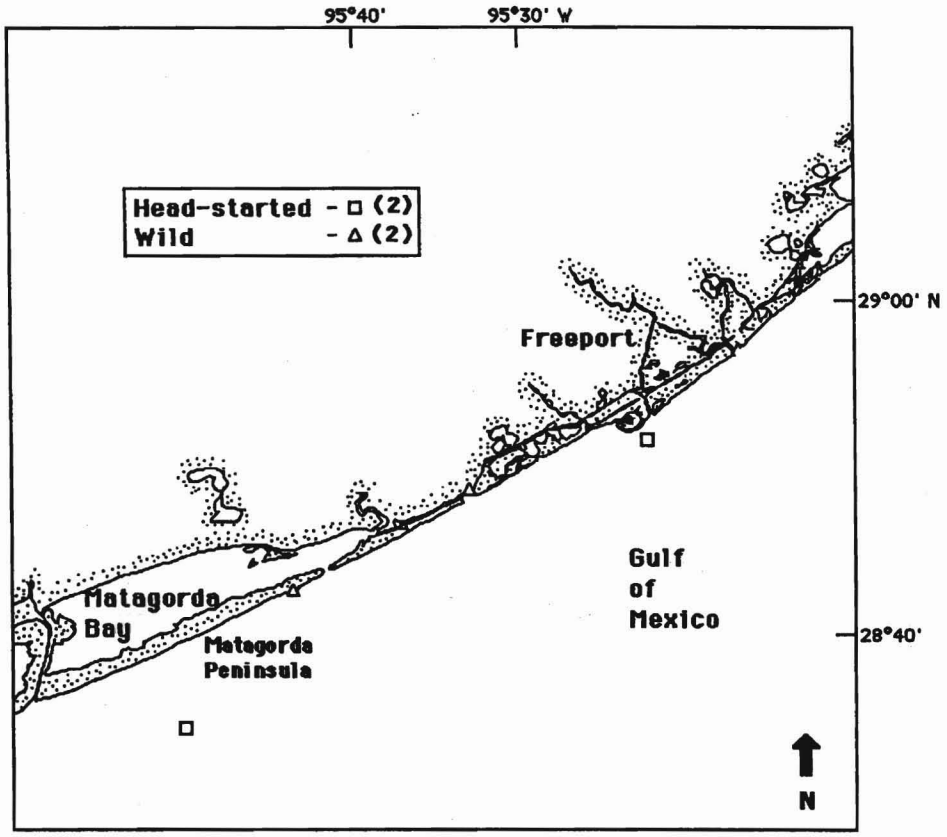


Summer

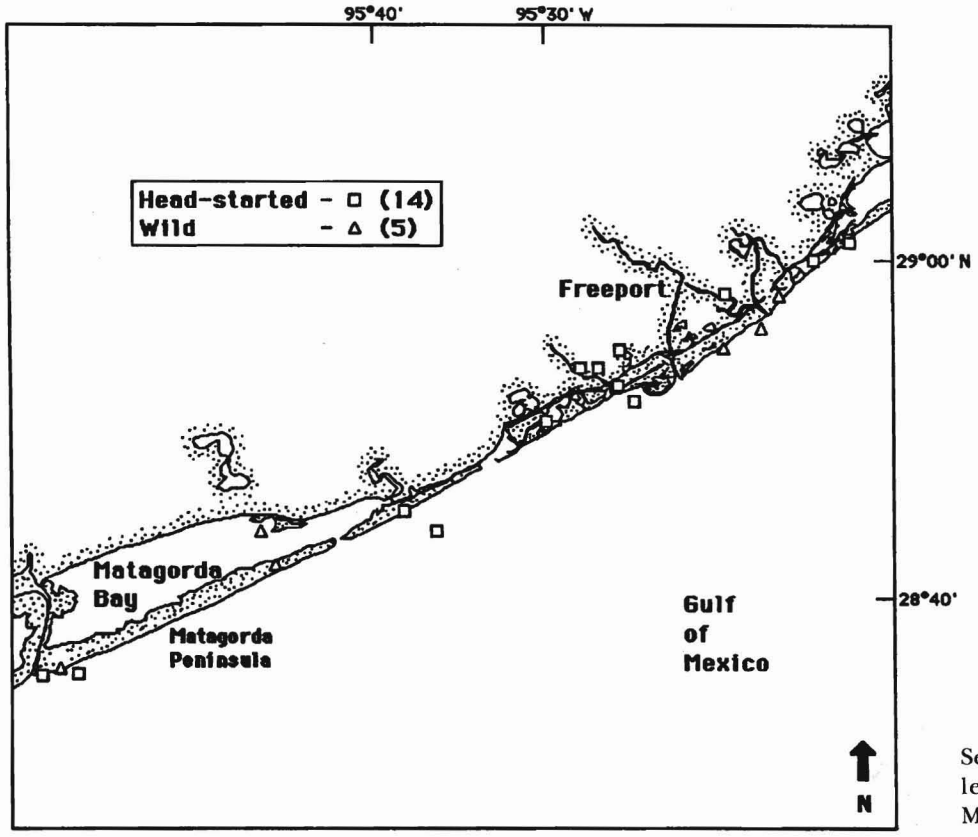


Fall

Figure 16 (continued)

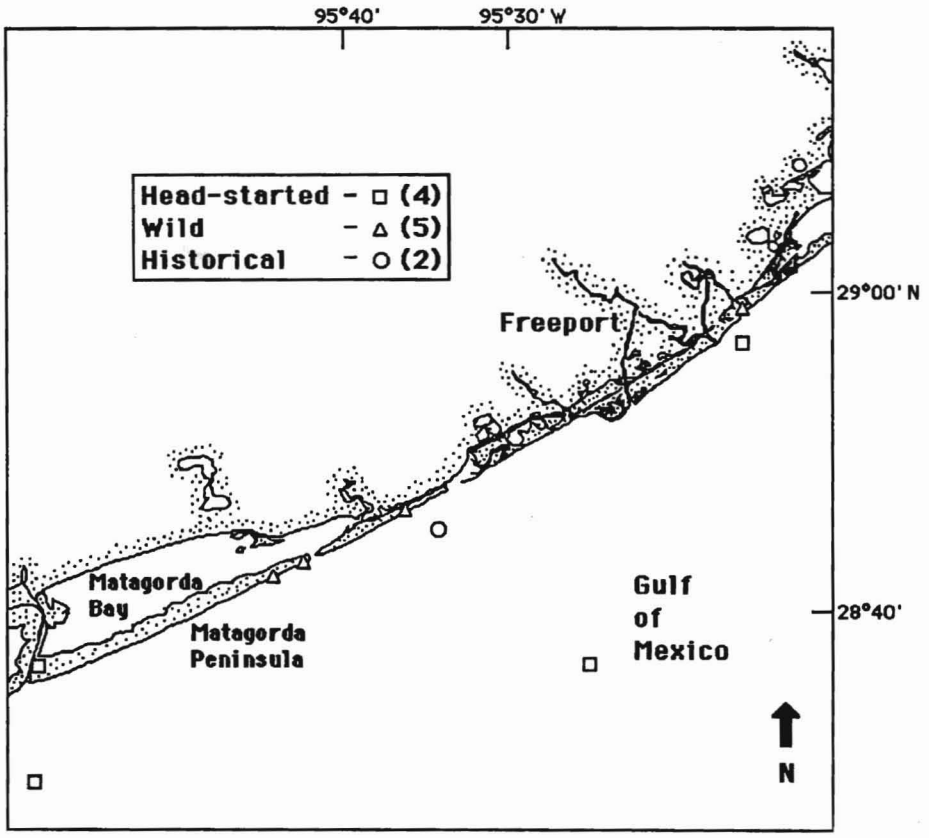


Winter

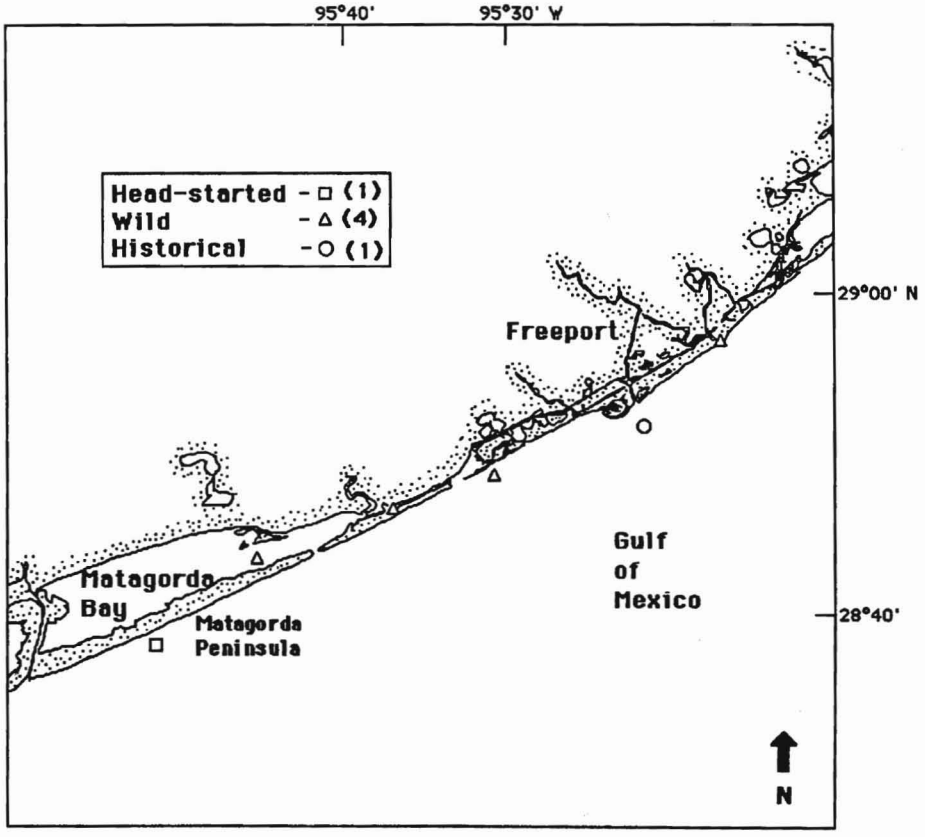


Spring

Figure 17
Seasonal distribution of Kemp's ridleys in region 3 - Freeport/East Matagorda Bay.

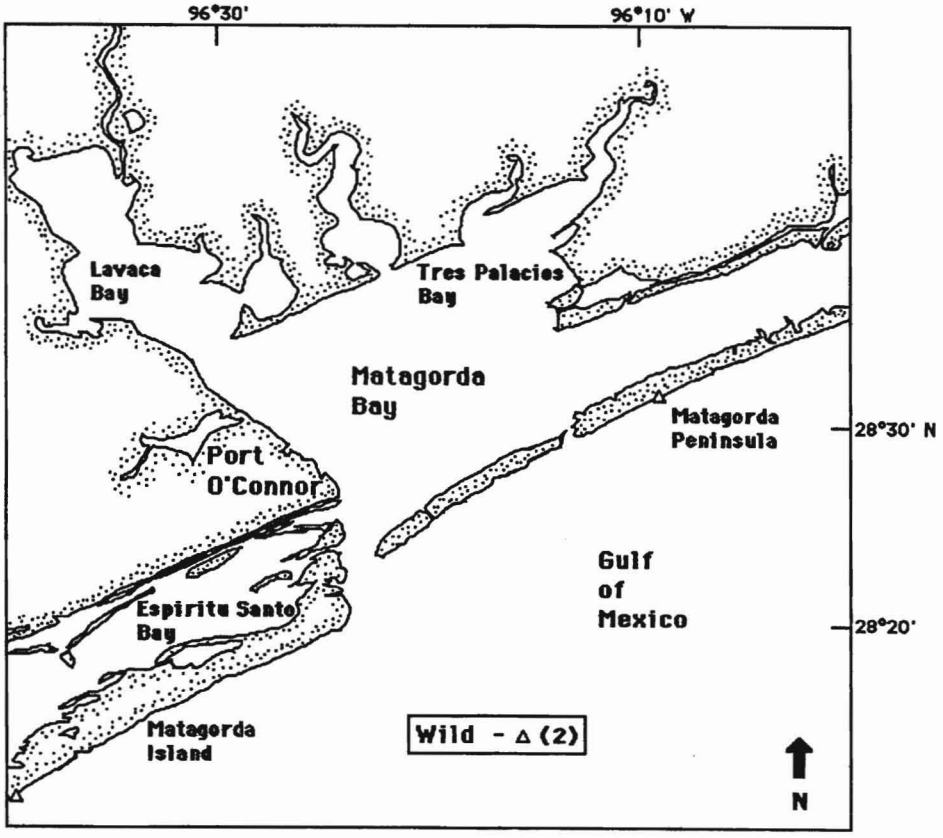


Summer

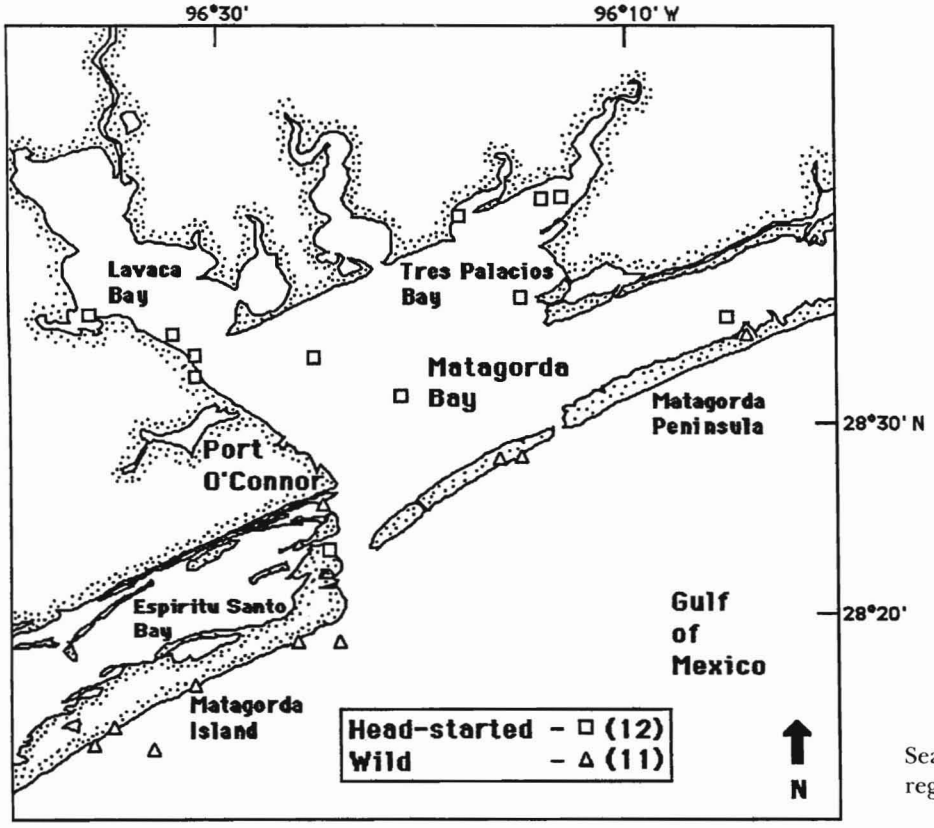


Fall

Figure 17 (continued)

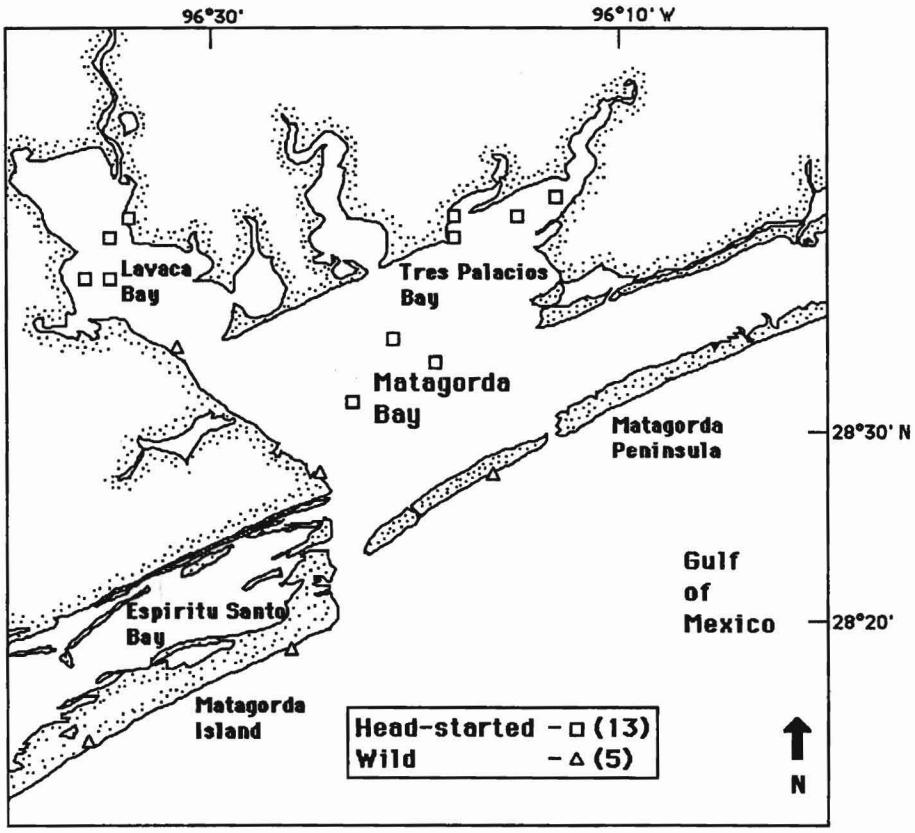


Winter

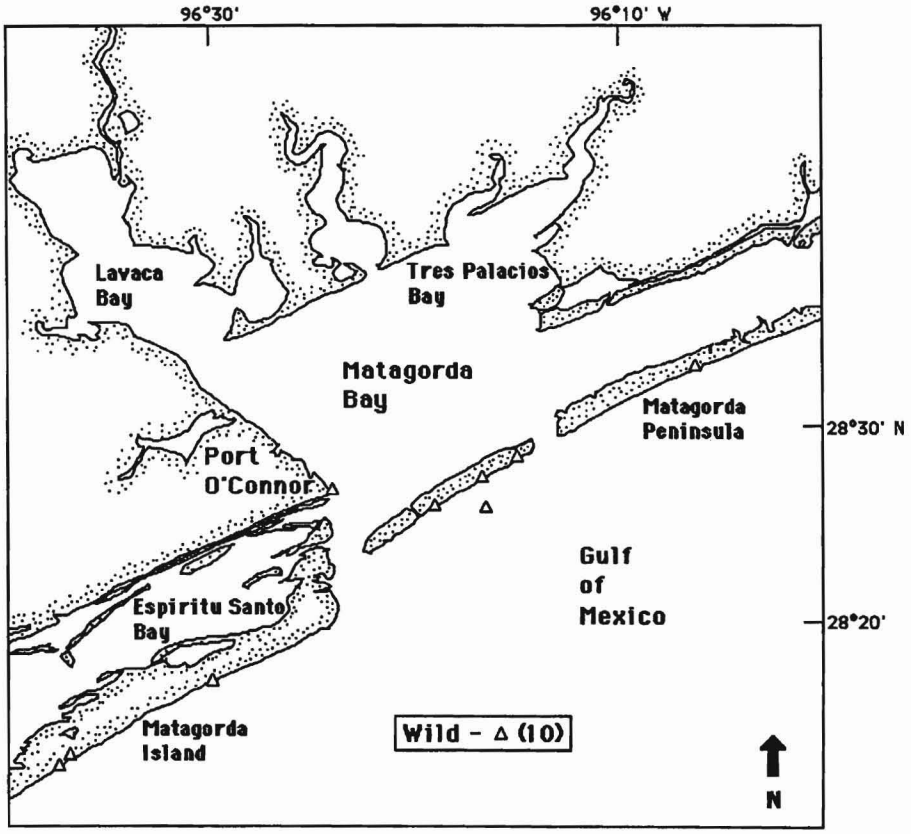


Spring

Figure 18
Seasonal distribution of Kemp's ridleys in region 4 - Matagorda Bay and Peninsula.

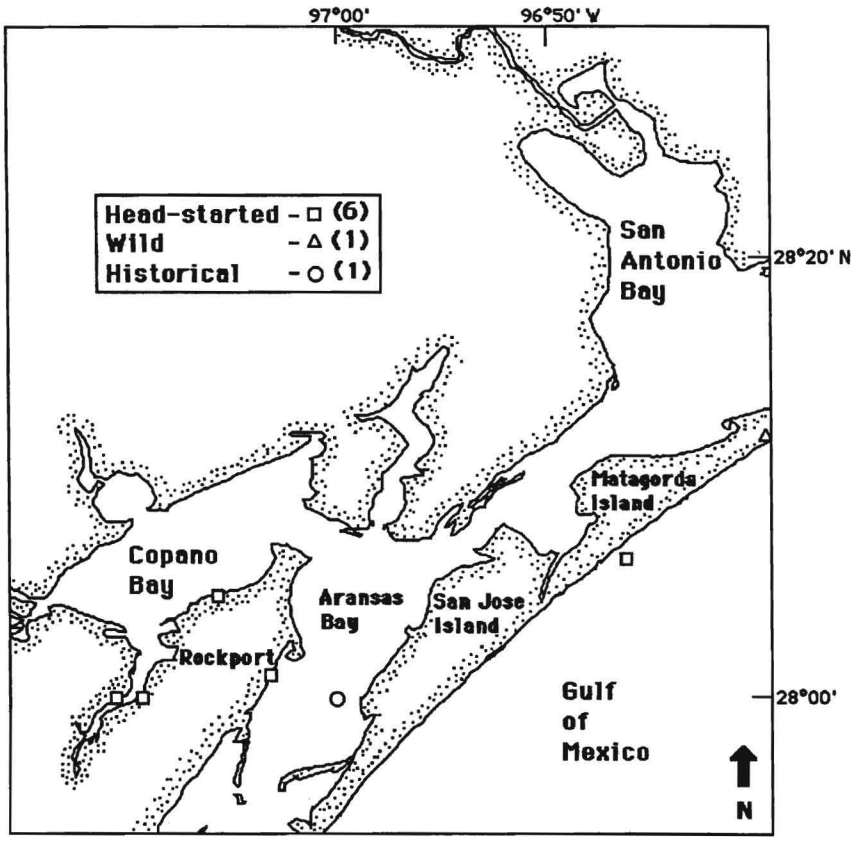


Summer



Fall

Figure 18 (continued)



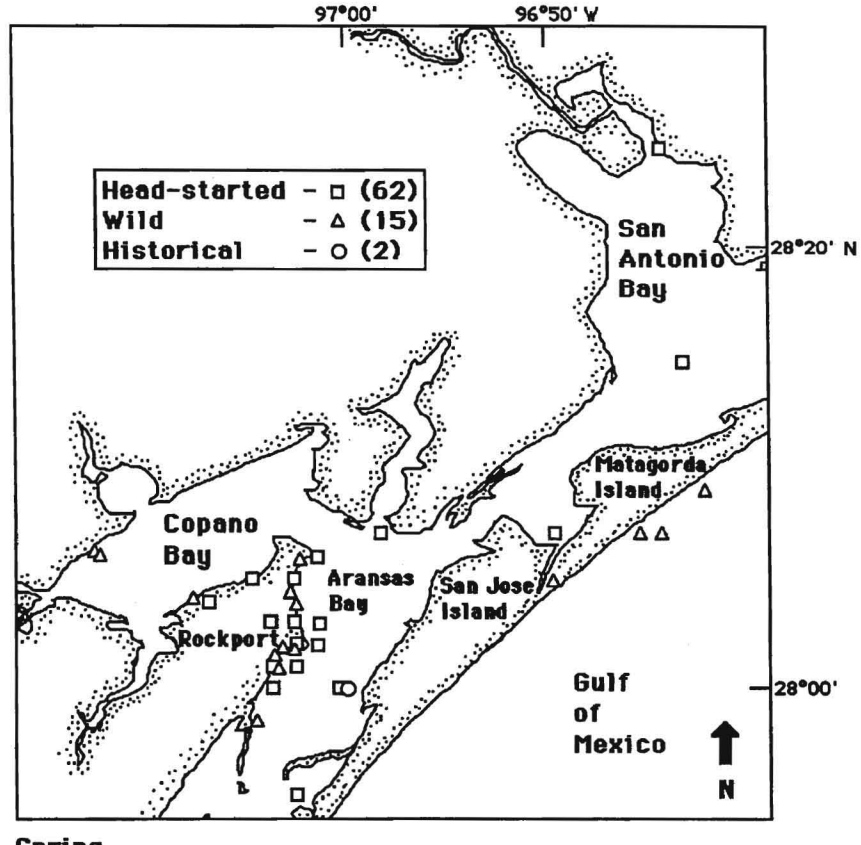
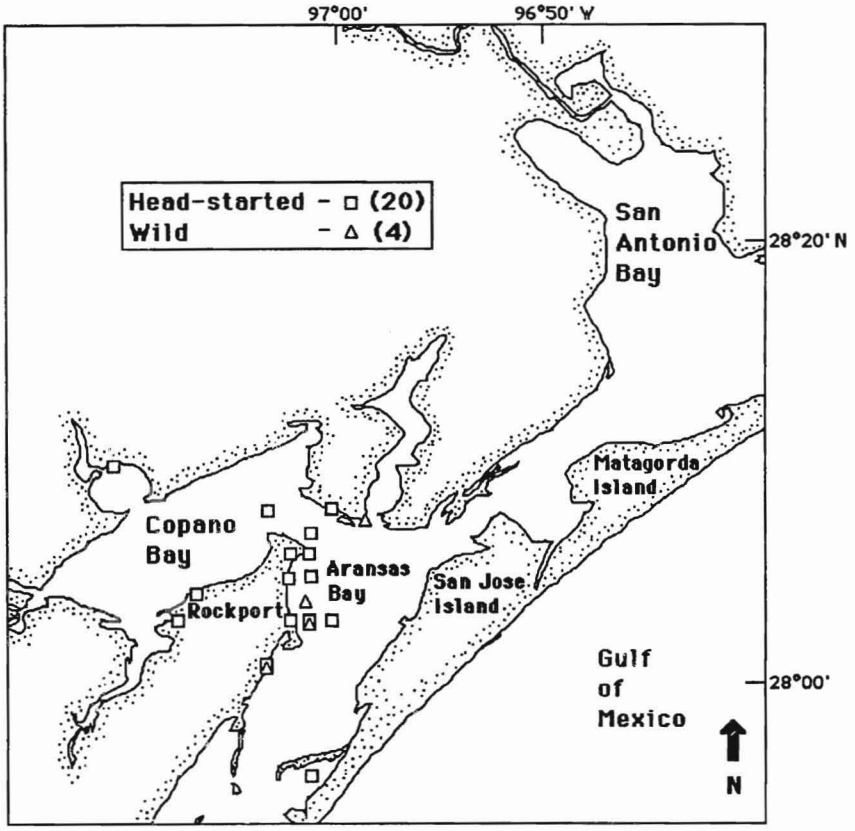
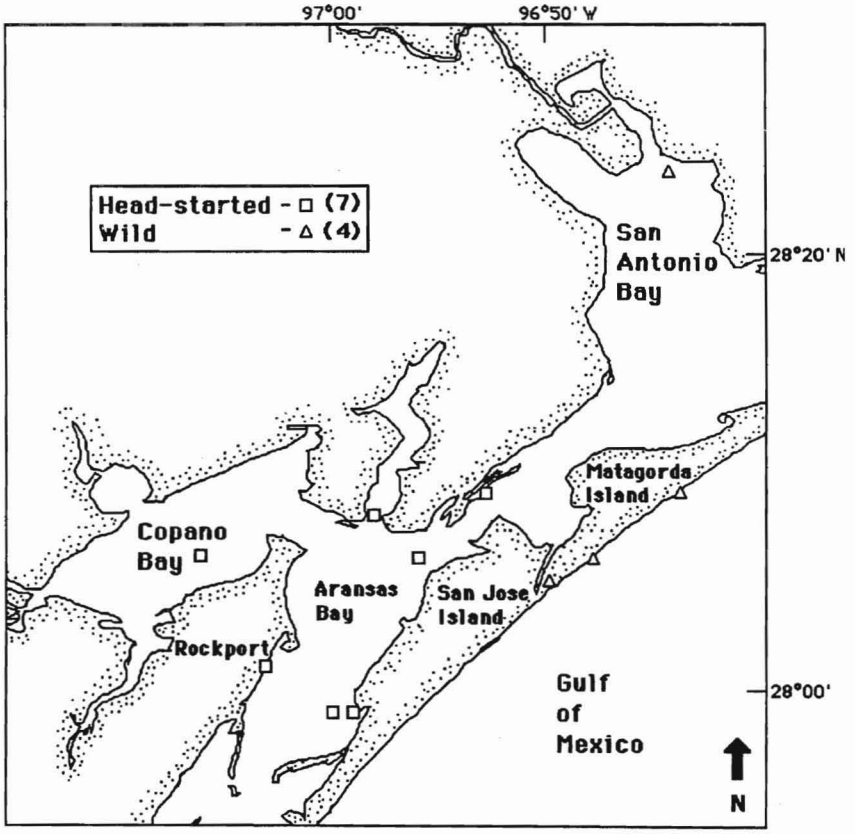


Figure 19
Seasonal distribution of Kemp's ridleys in region 5 - San Antonio Bay/Copano Bay/ Matagorda Island.

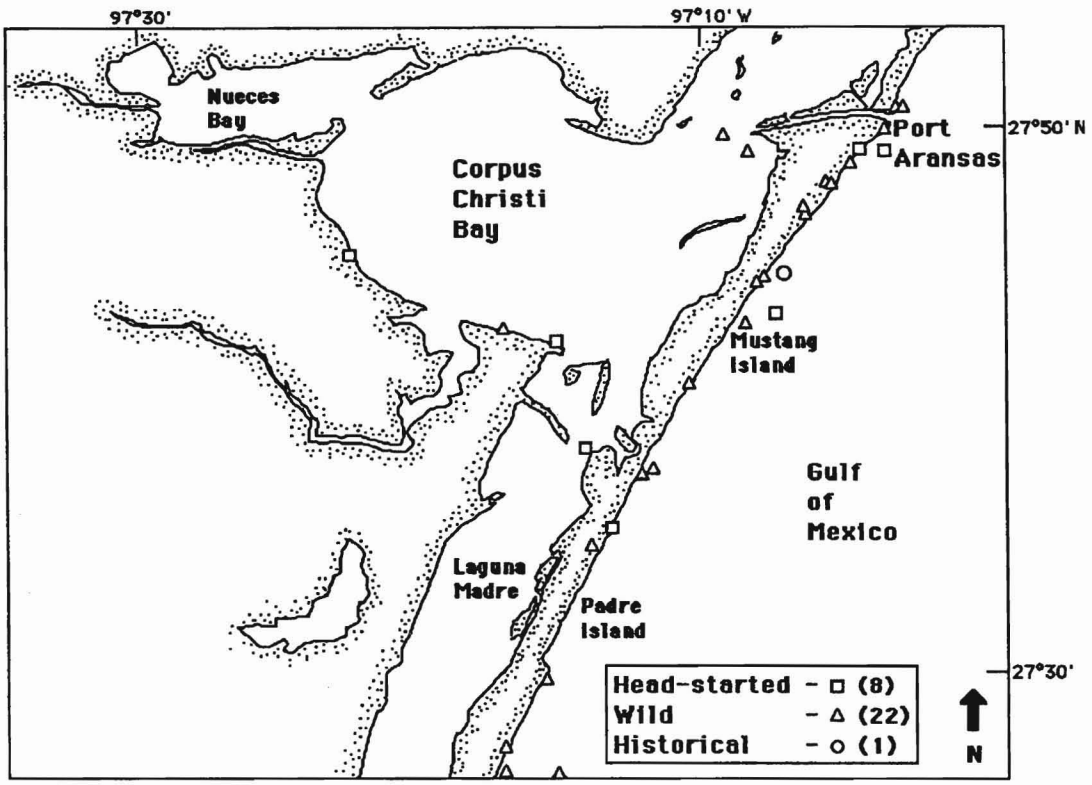


Summer

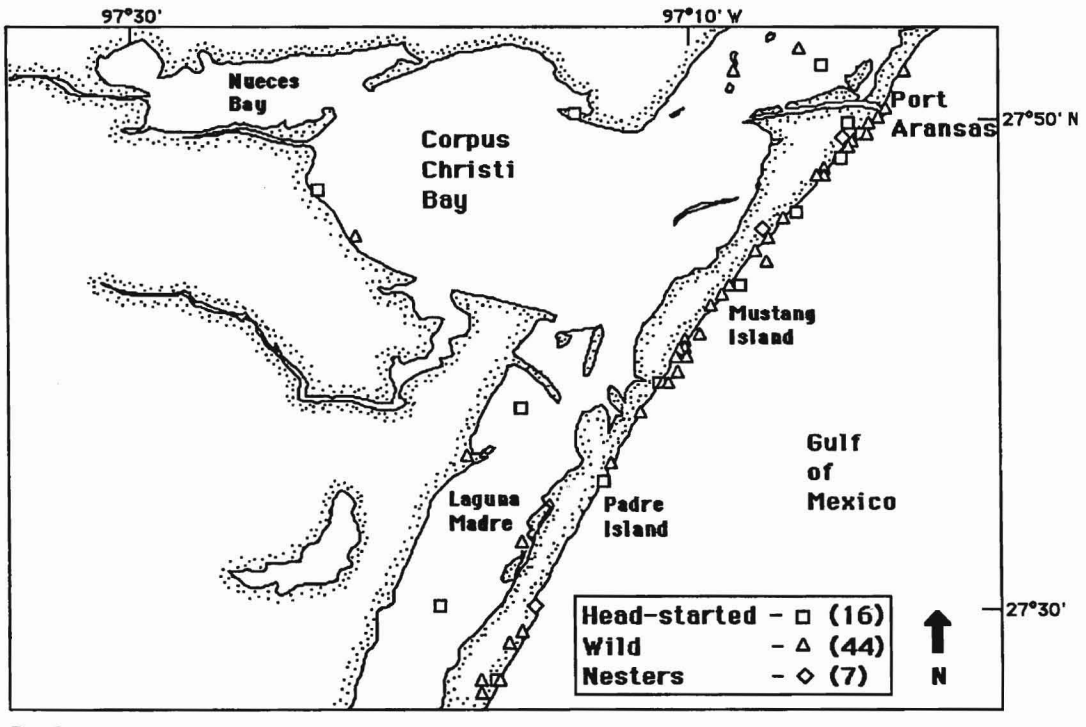


Fall

Figure 19 (continued)

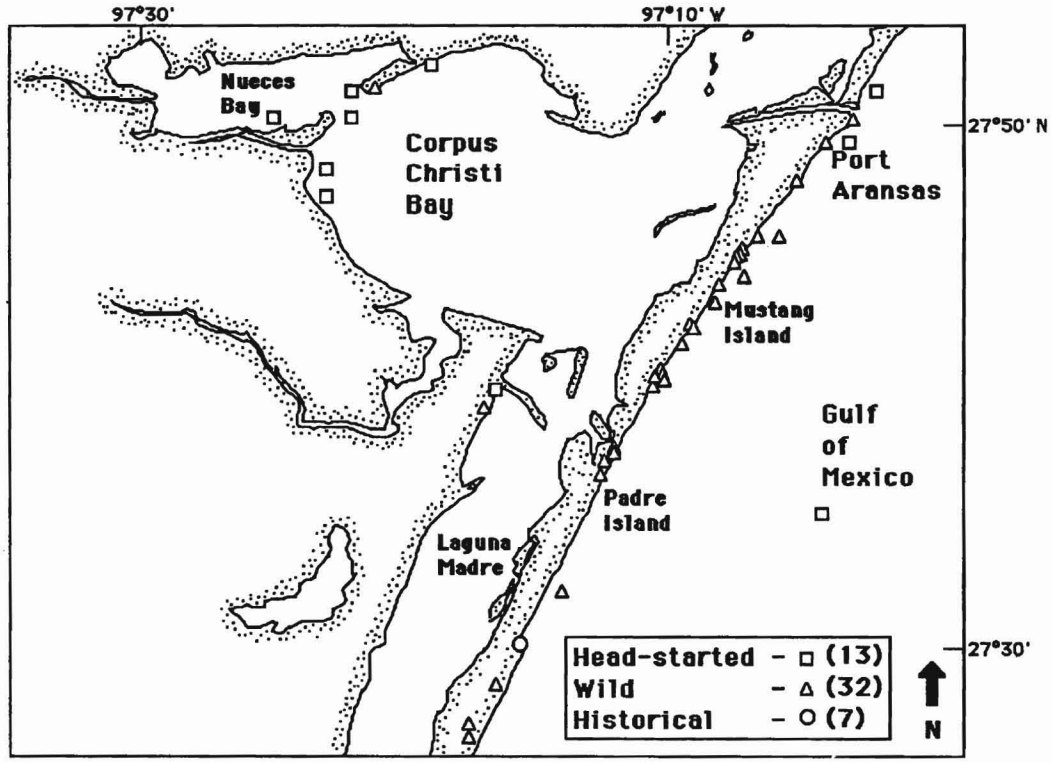


Winter

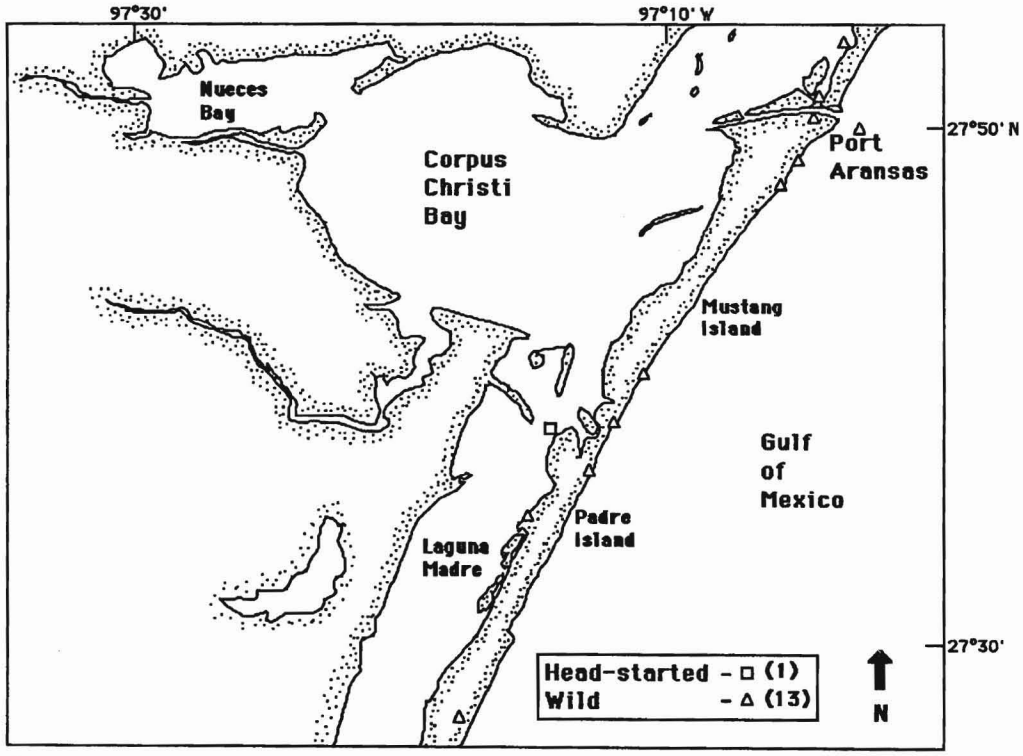


Spring

Figure 20
Seasonal distribution of Kemp's ridleys in region 6 - Corpus Christi Bay/Northern Padre Island.

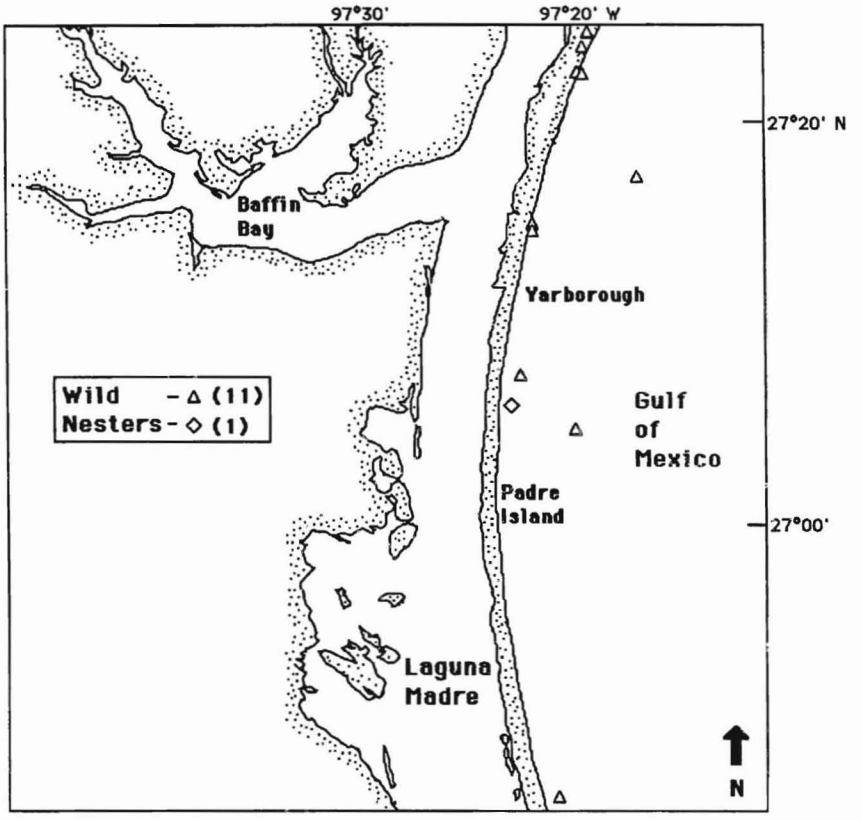


Summer

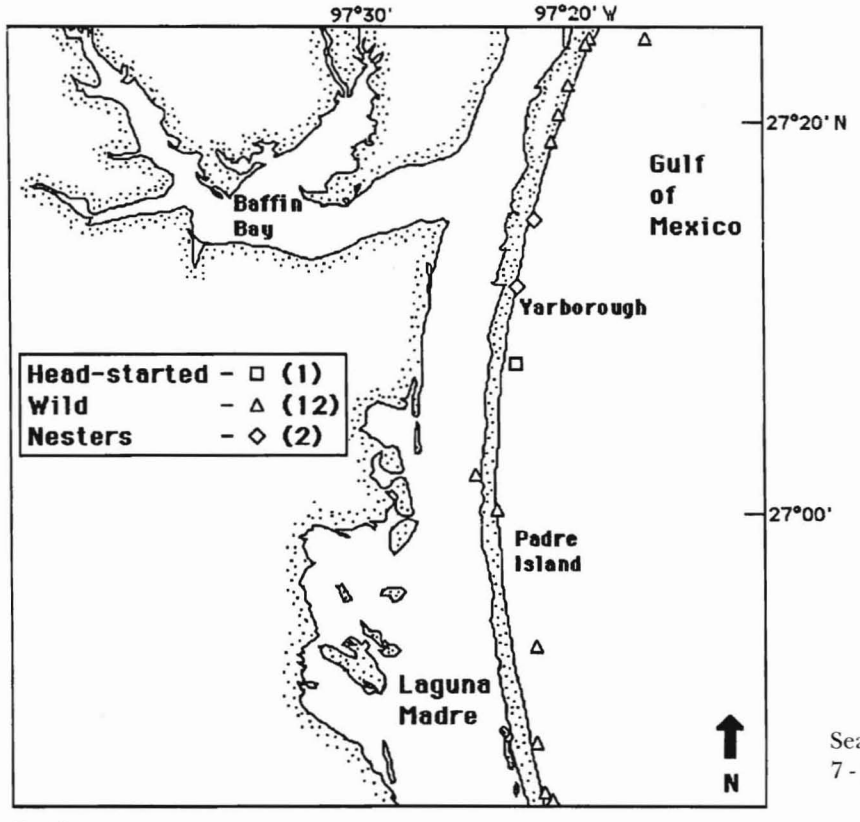


Fall

Figure 20 (continued)

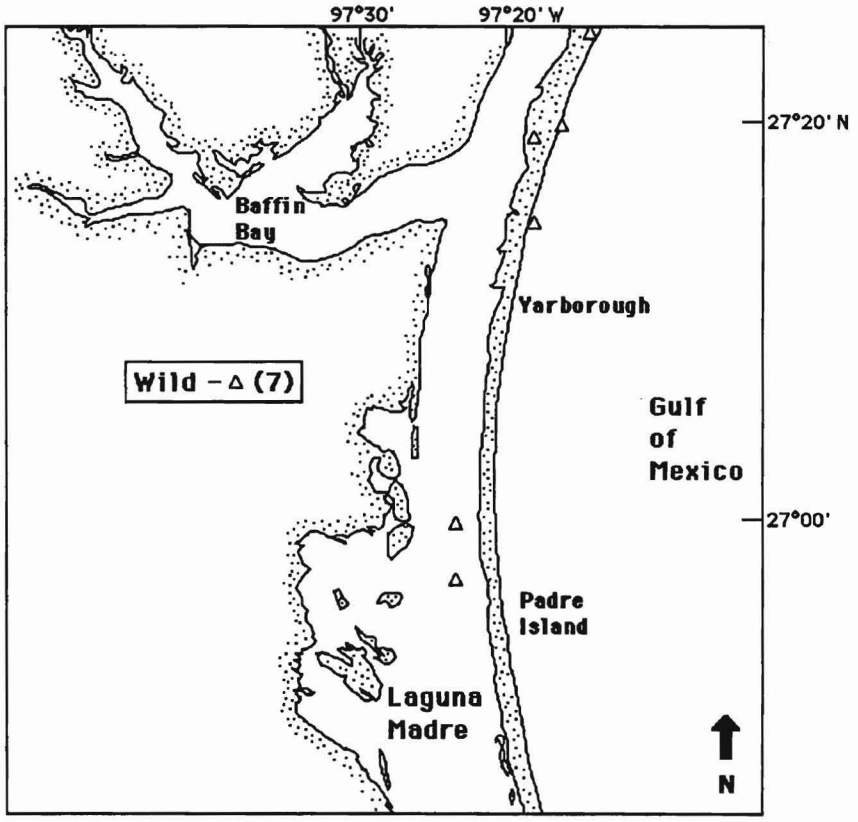


Winter

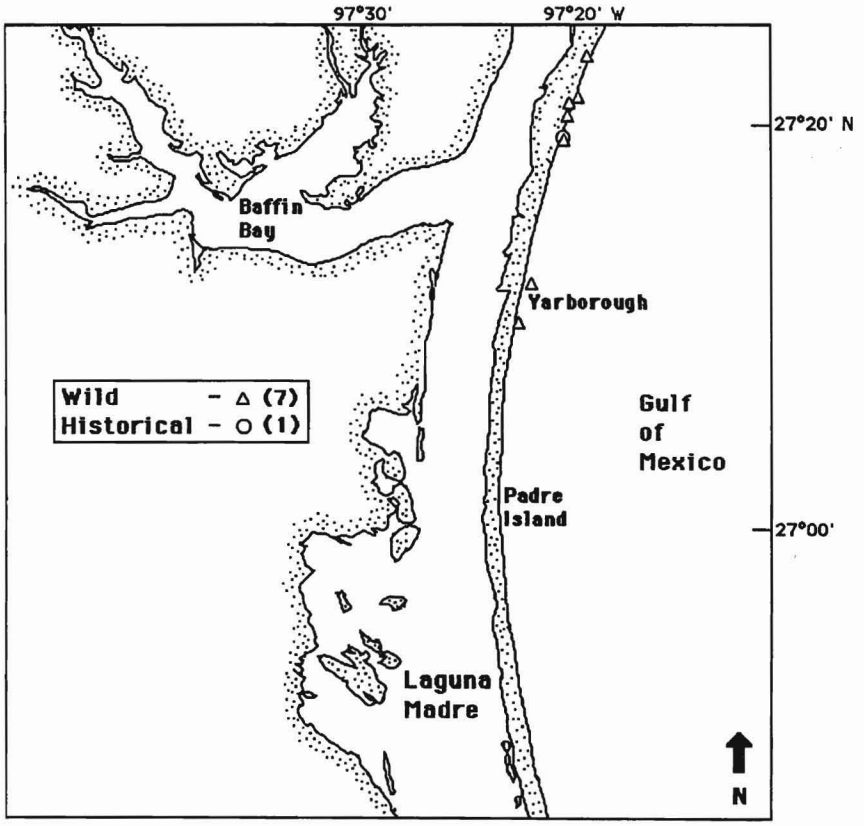


Spring

Figure 21
Seasonal distribution of Kemp's ridleys in region 7 - Central Laguna Madre/Padre Island.

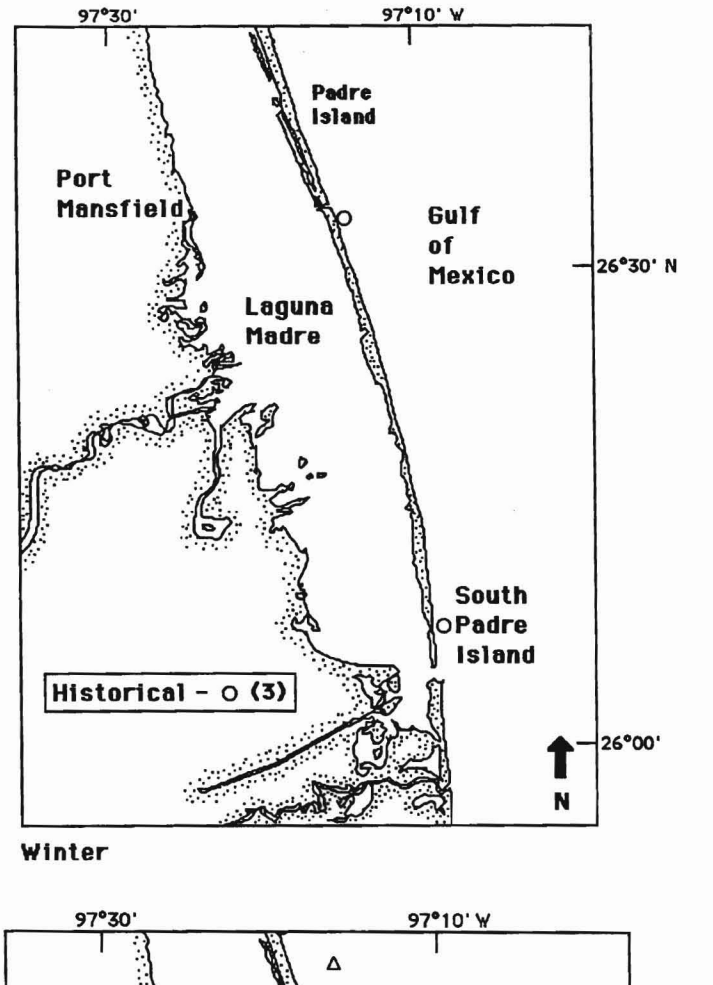


Summer



Fall

Figure 21 (continued)



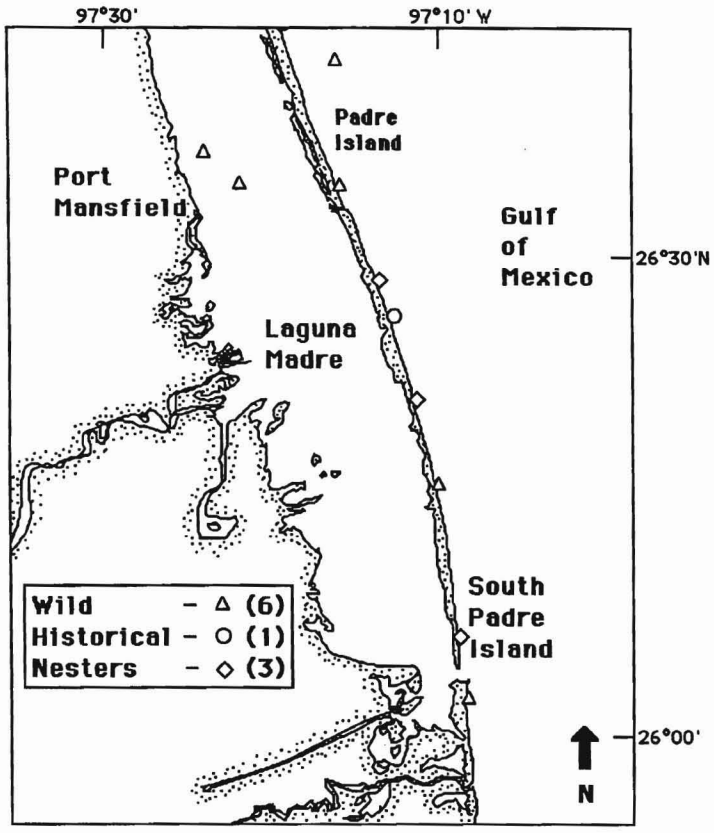
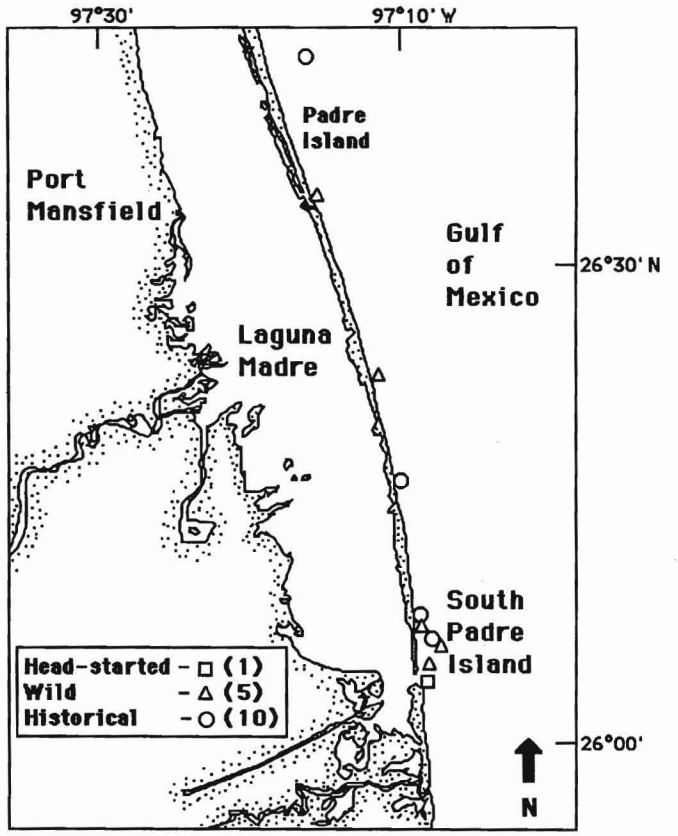
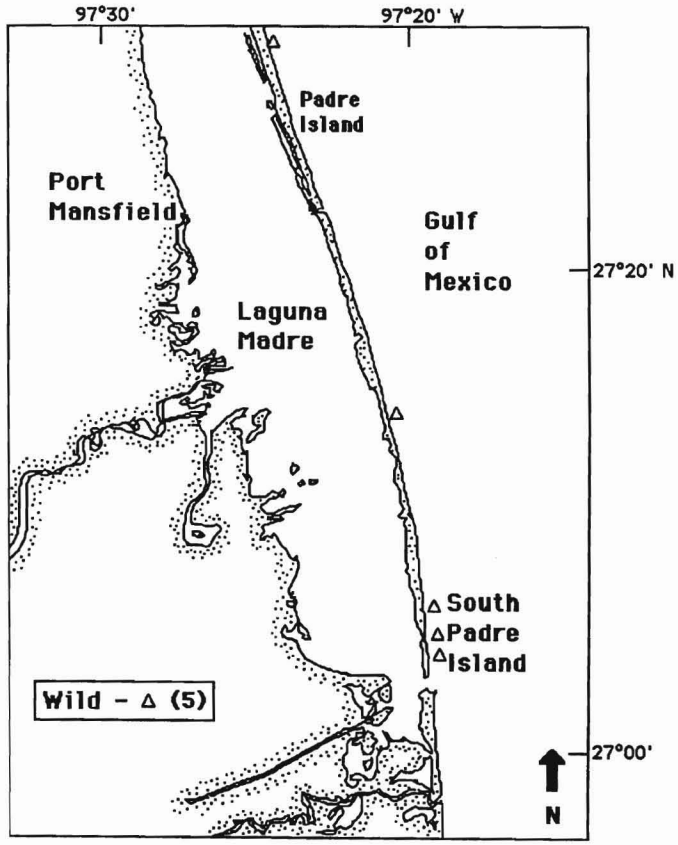


Figure 22
Seasonal distribution of Kemp's ridleys in region 8 - Southern Laguna Madre/Padre Island.

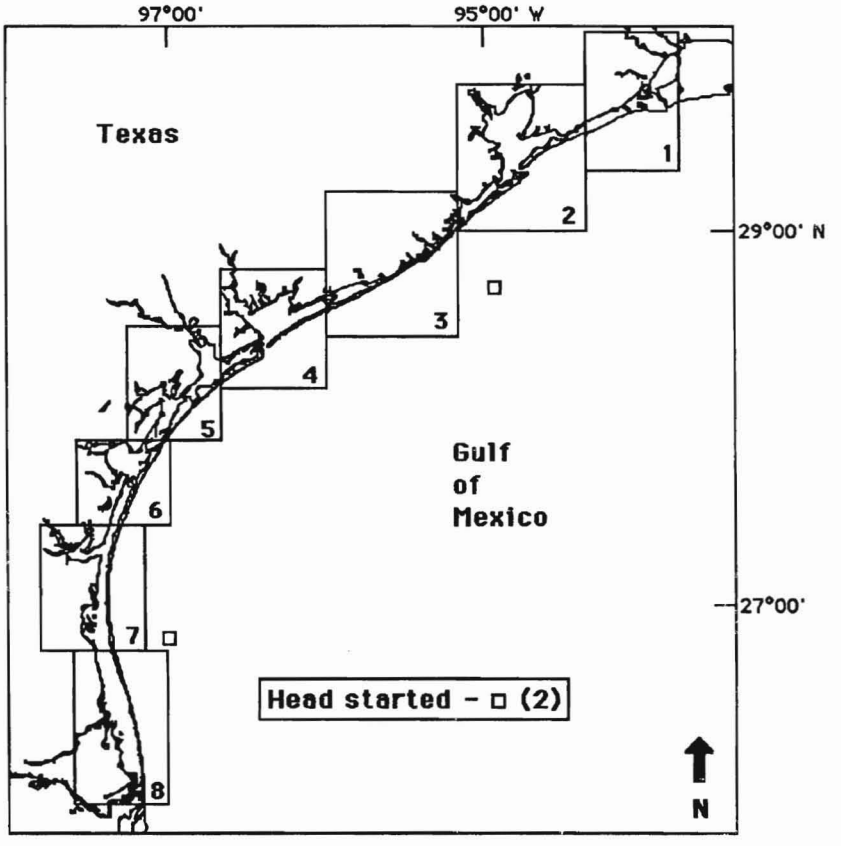


Summer

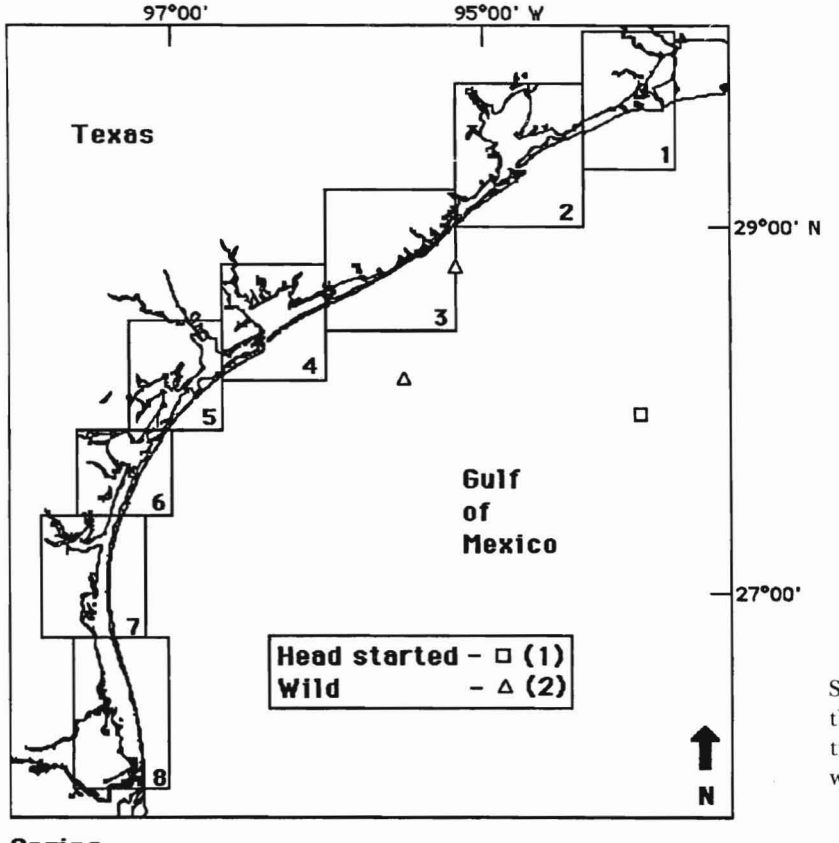


Fall

Figure 22 (continued)

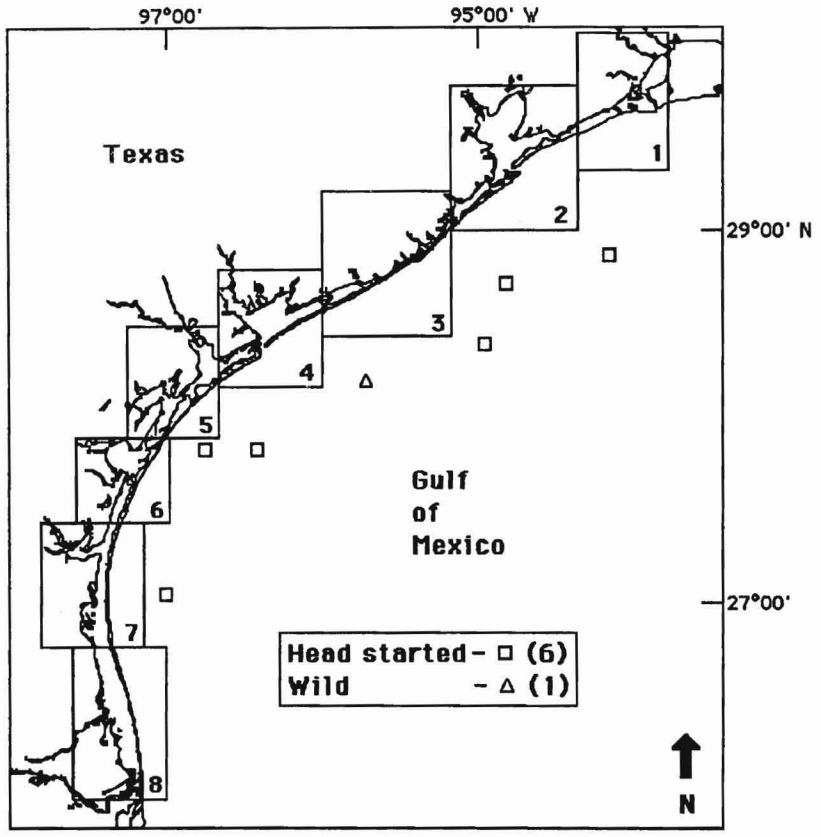


Winter

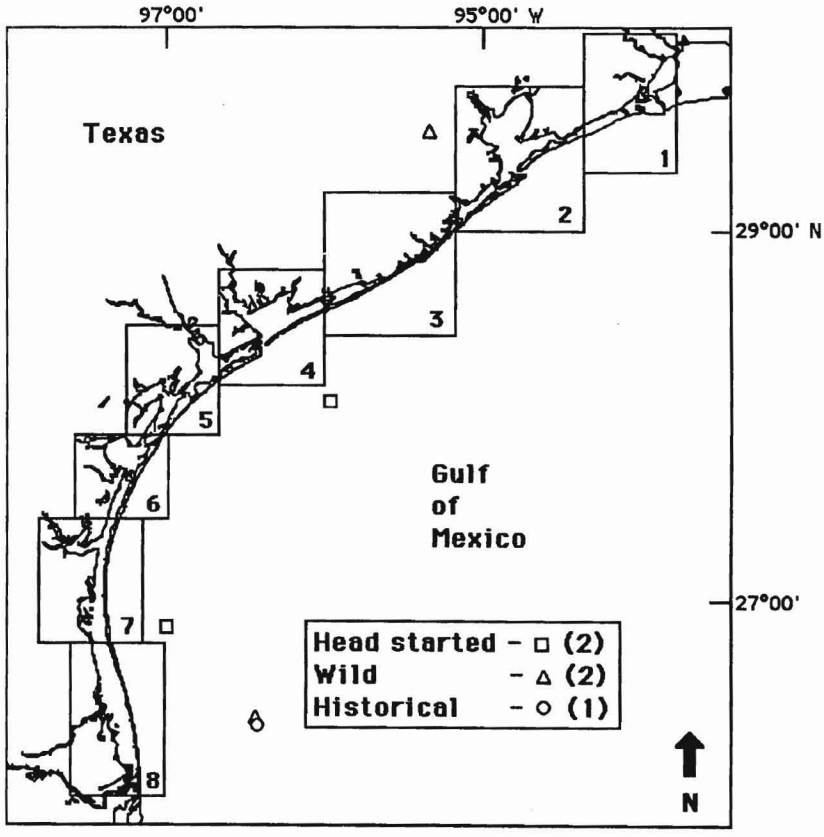


Spring

Figure 23
Seasonal distribution of Kemp's ridleys outside the regional boundaries. The wild turtle positioned on land near region 2 on the Fall map, was found in a drainage ditch in Houston, TX.



Summer



Fall

Figure 23 (continued)

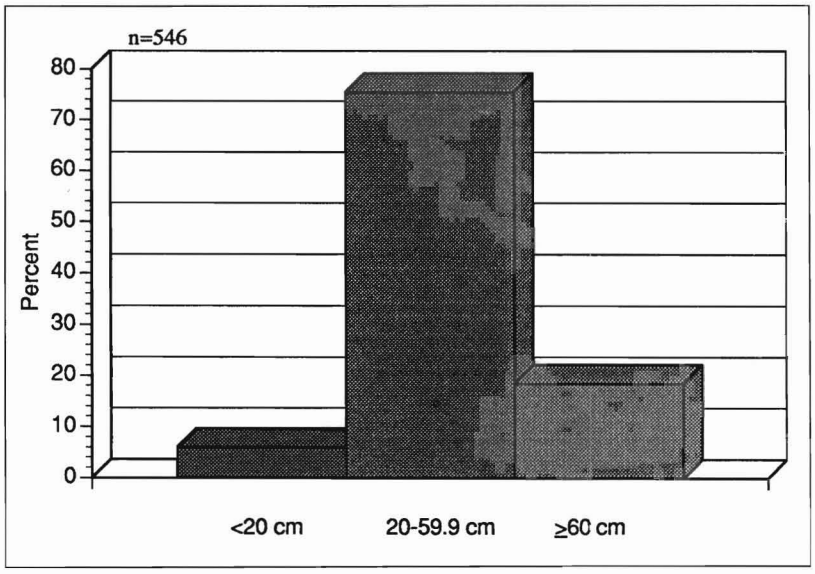


Figure 24
Curved carapace length measurements of Kemp's ridleys found along the Texas coast.

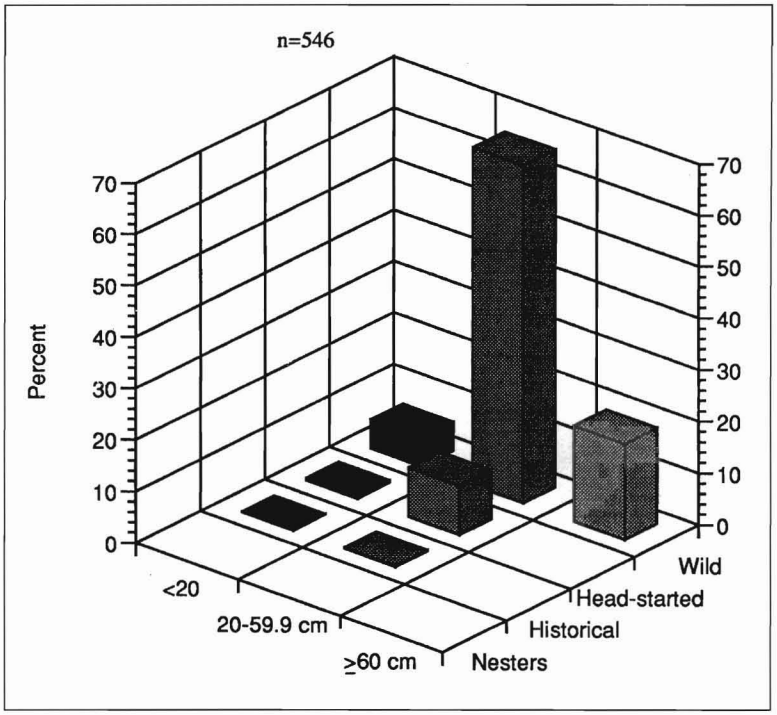
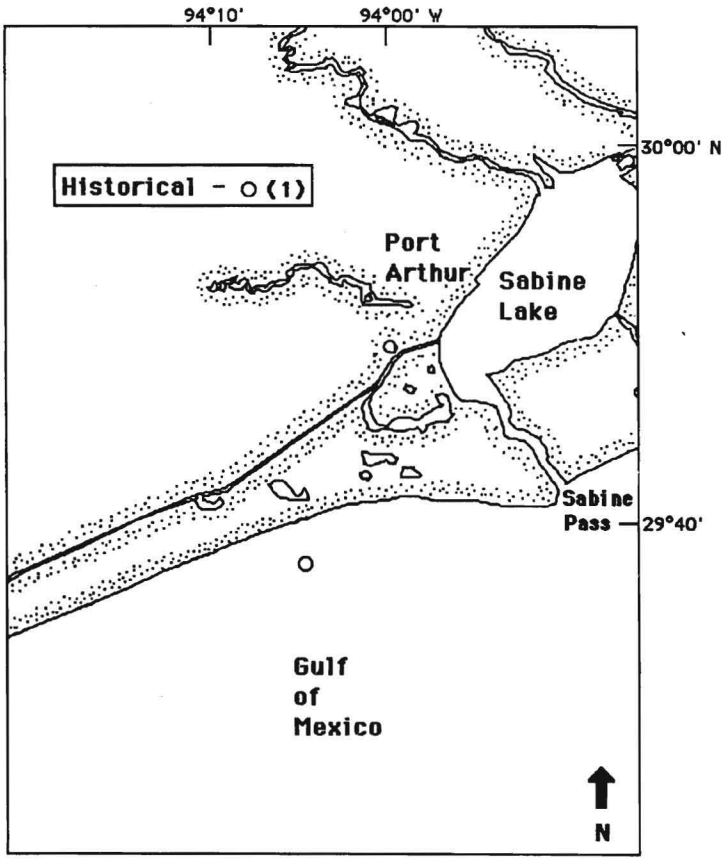


Figure 25
Frequency distribution of Kemp's ridley groups, by curved carapace lengths.



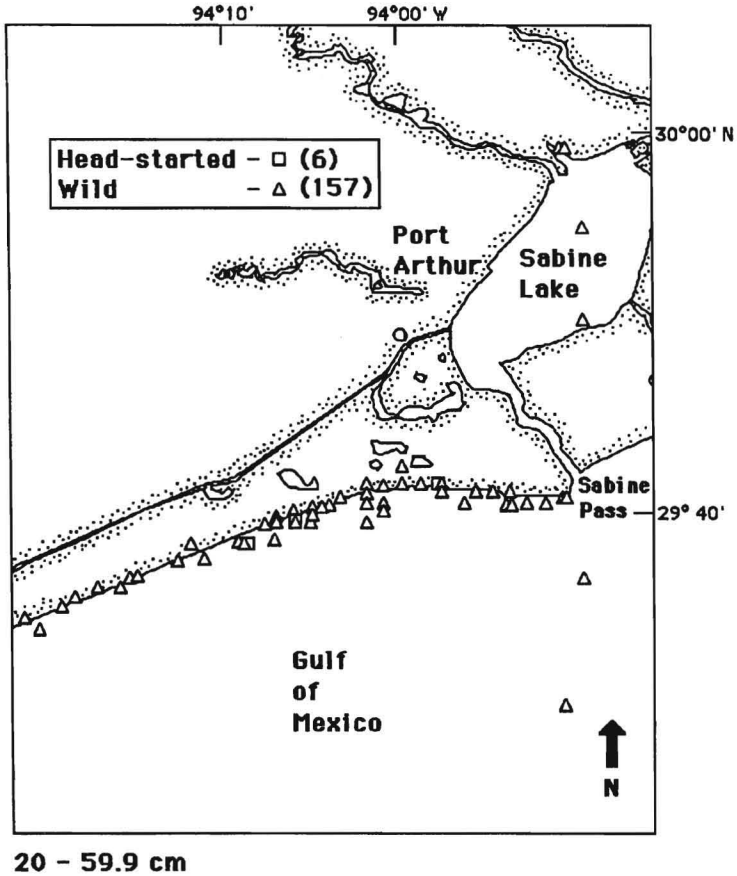


Figure 26
Size distribution of Kemp's ridleys in region 1 - Sabine Pass/High Island area.

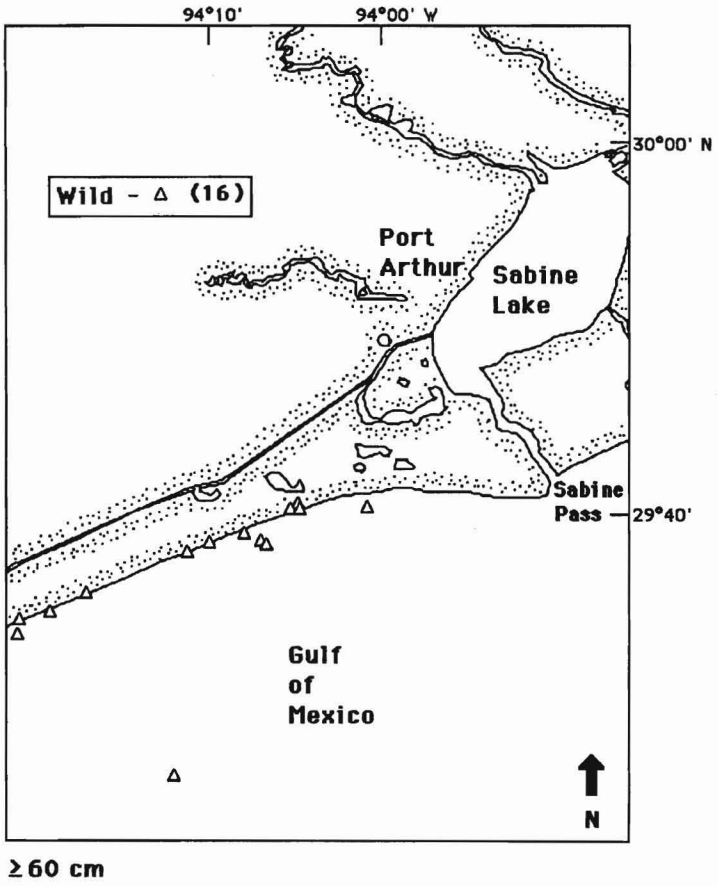
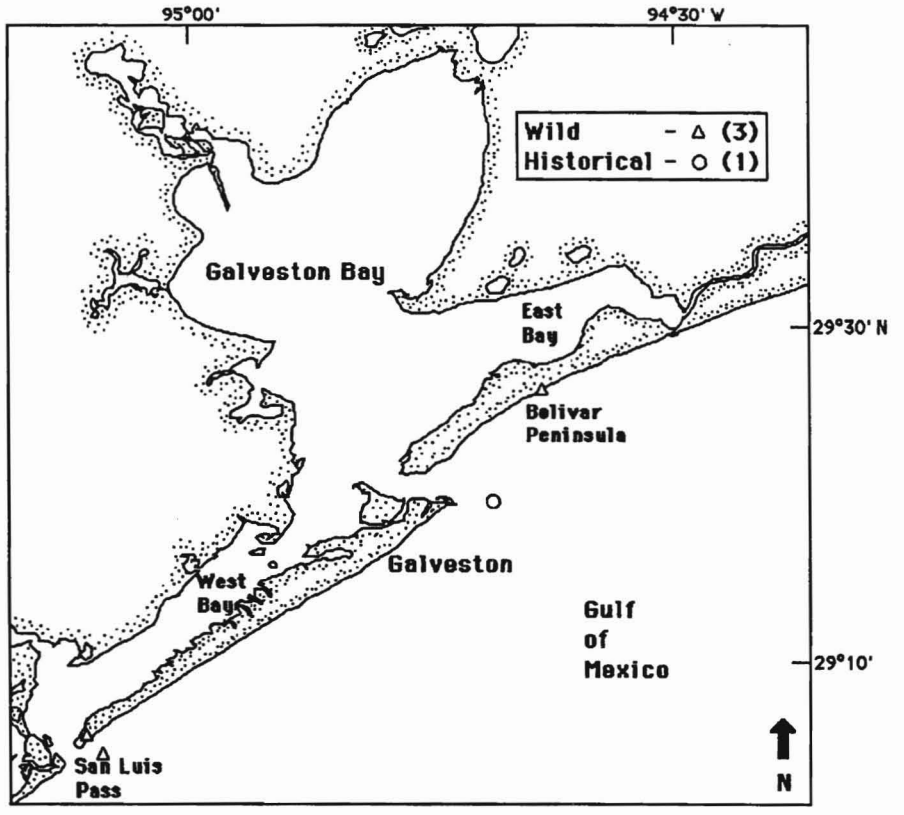
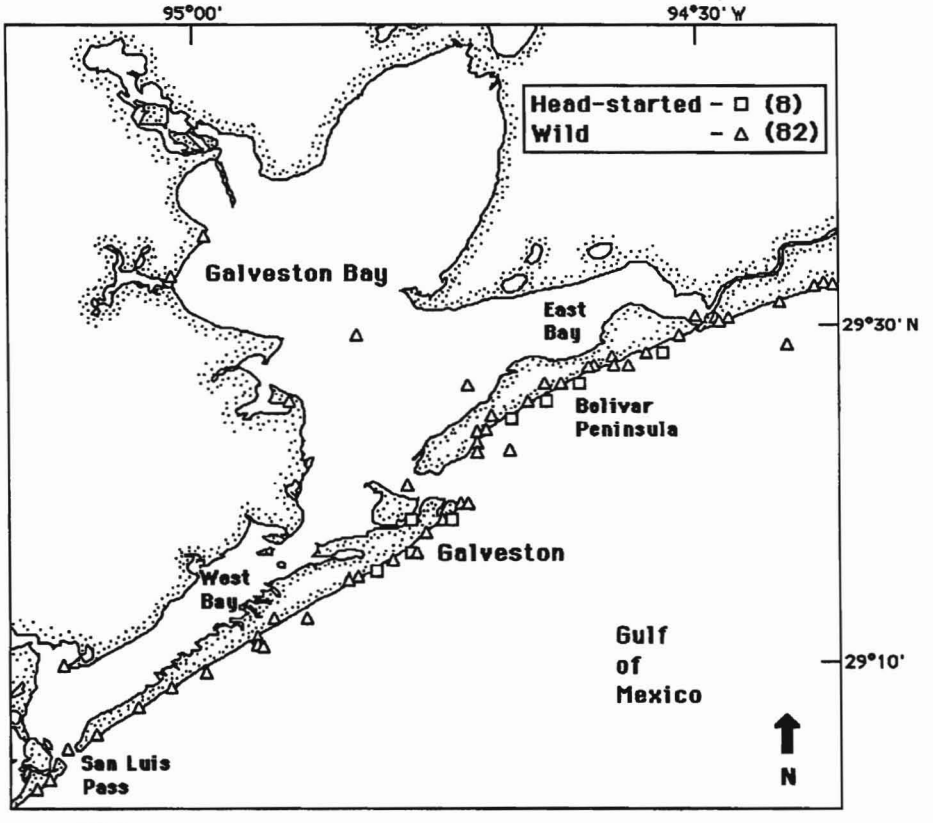


Figure 26 (continued)



< 20 cm



20 - 59.9 cm

Figure 27
Size distribution of Kemp's ridleys in region 2 - Bolivar Peninsula/Galveston area.

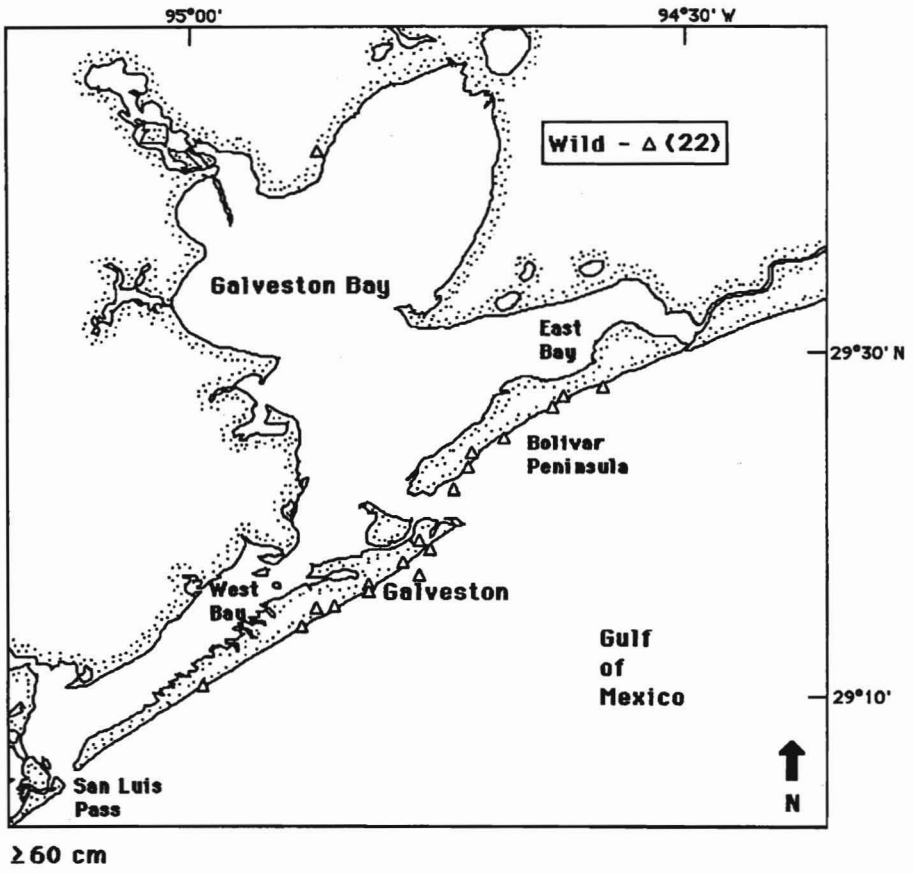
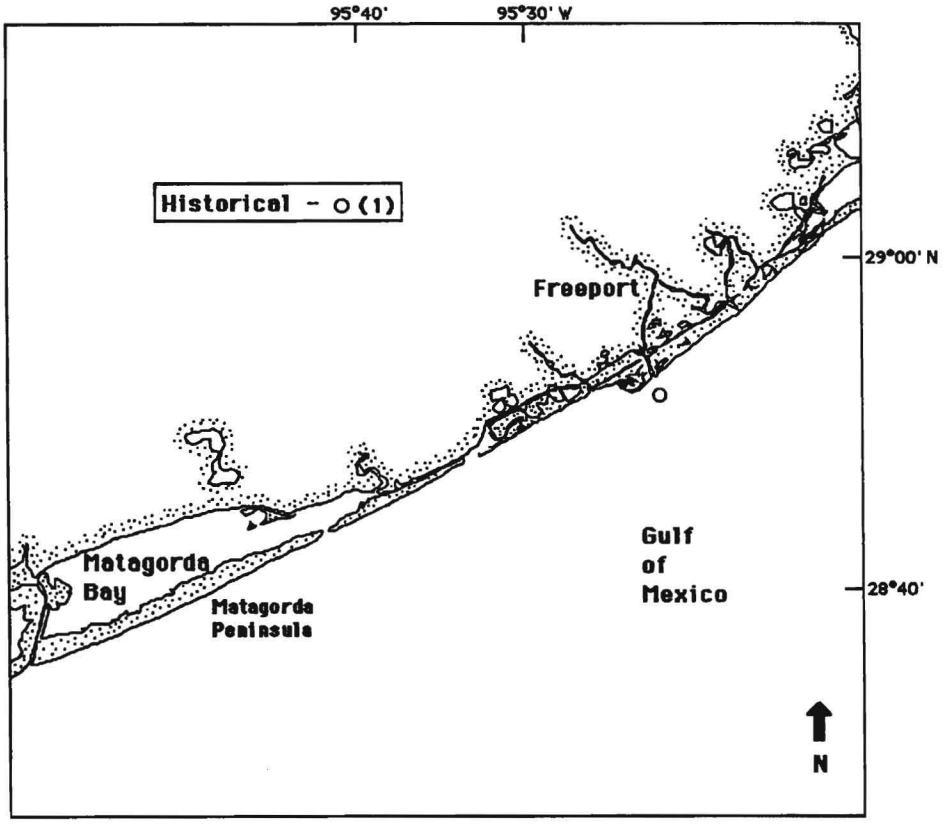
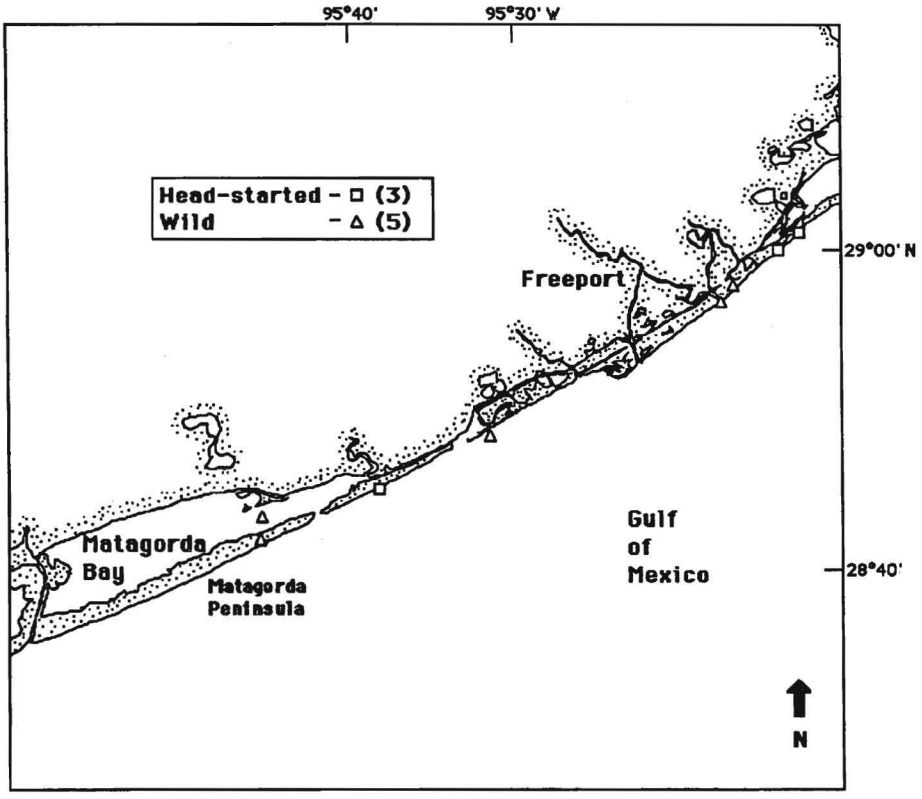


Figure 27 (continued)



< 20 cm



20 - 59.9 cm

Figure 28
Size distribution of Kemp's ridleys in region 3 - Freeport/East Matagorda Bay.

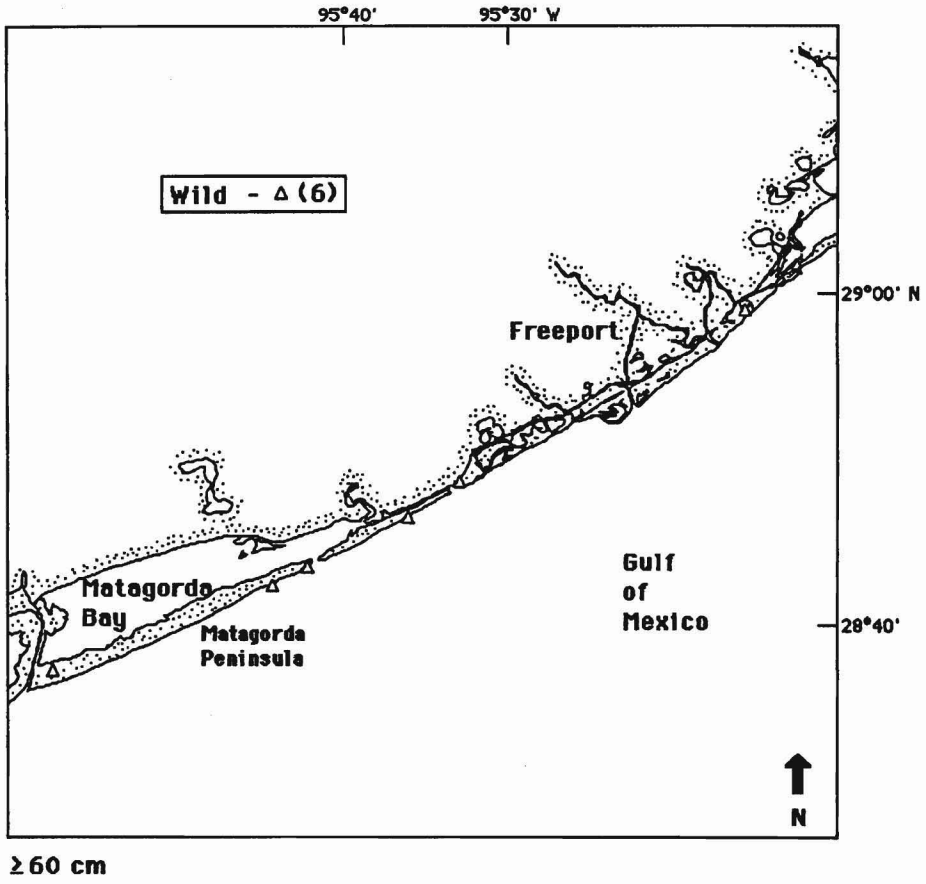
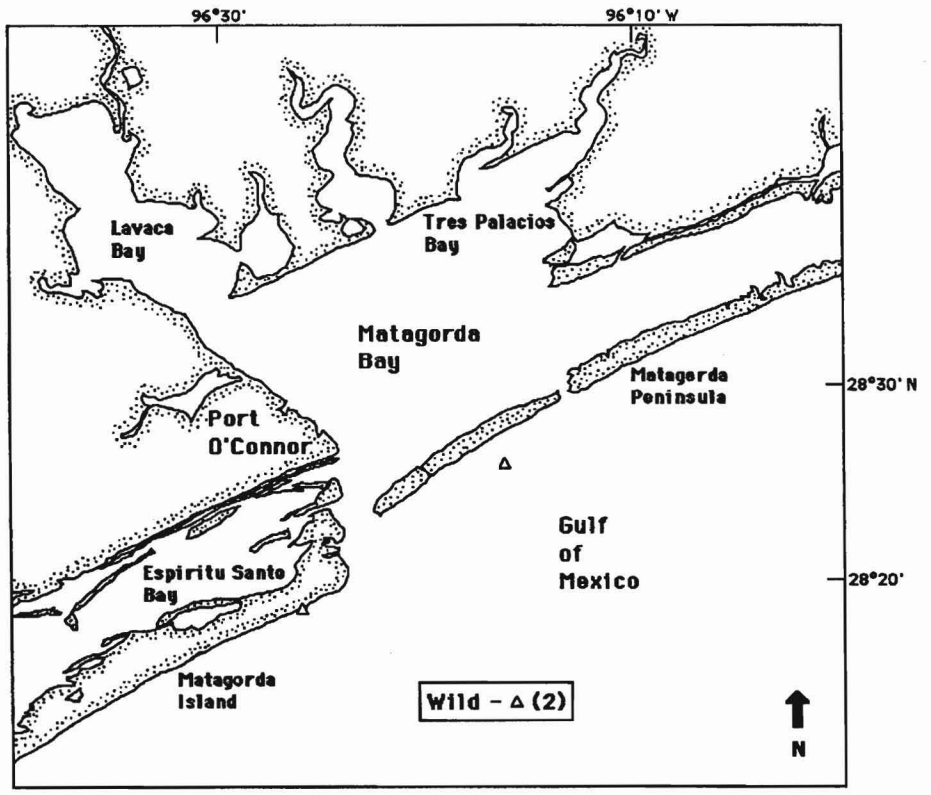
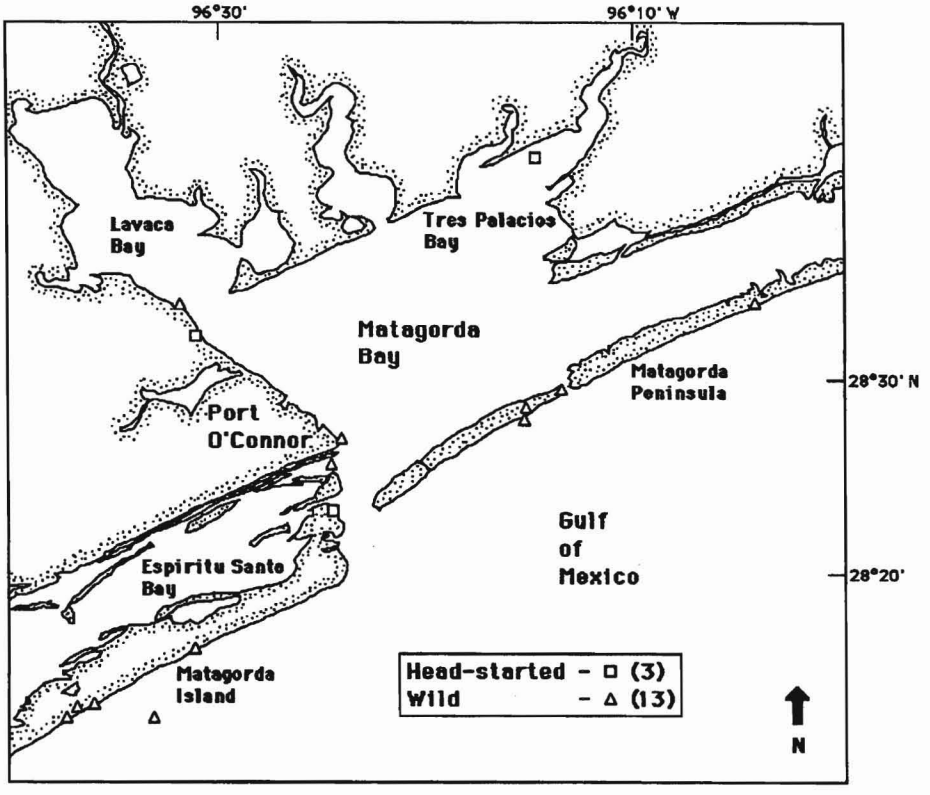


Figure 28 (continued)



< 20 cm



20 - 59.9 cm

Figure 29
Size distribution of Kemp's ridleys in region 4 - Matagorda Bay and Peninsula.

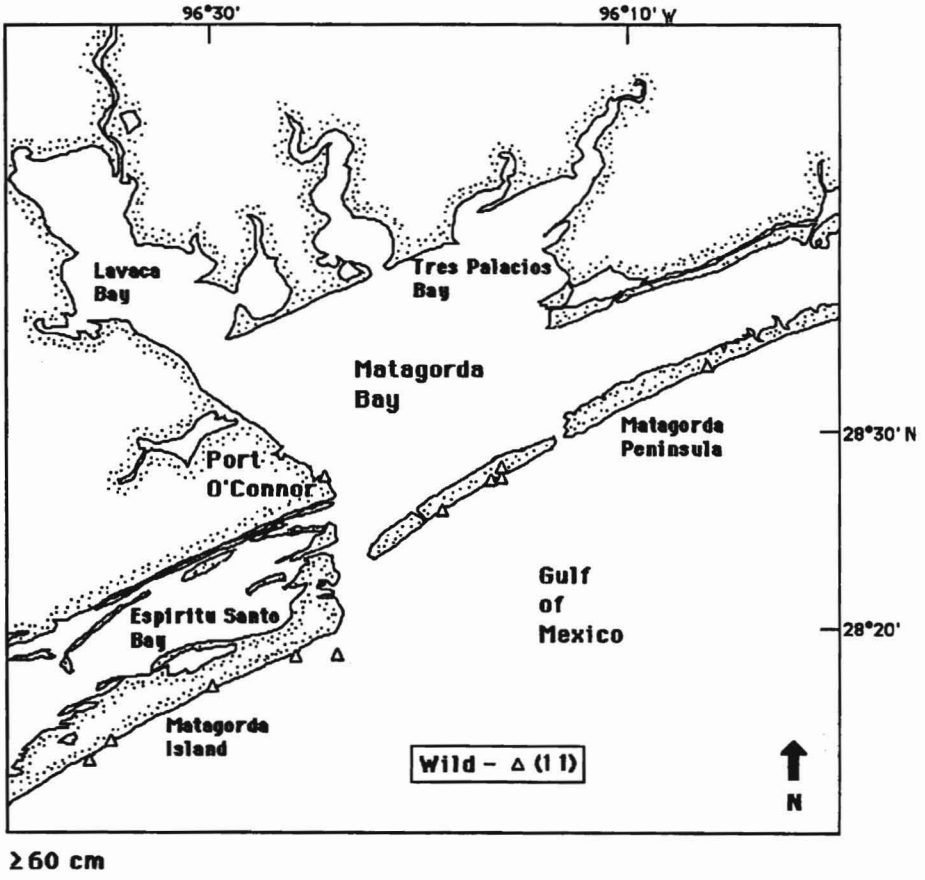
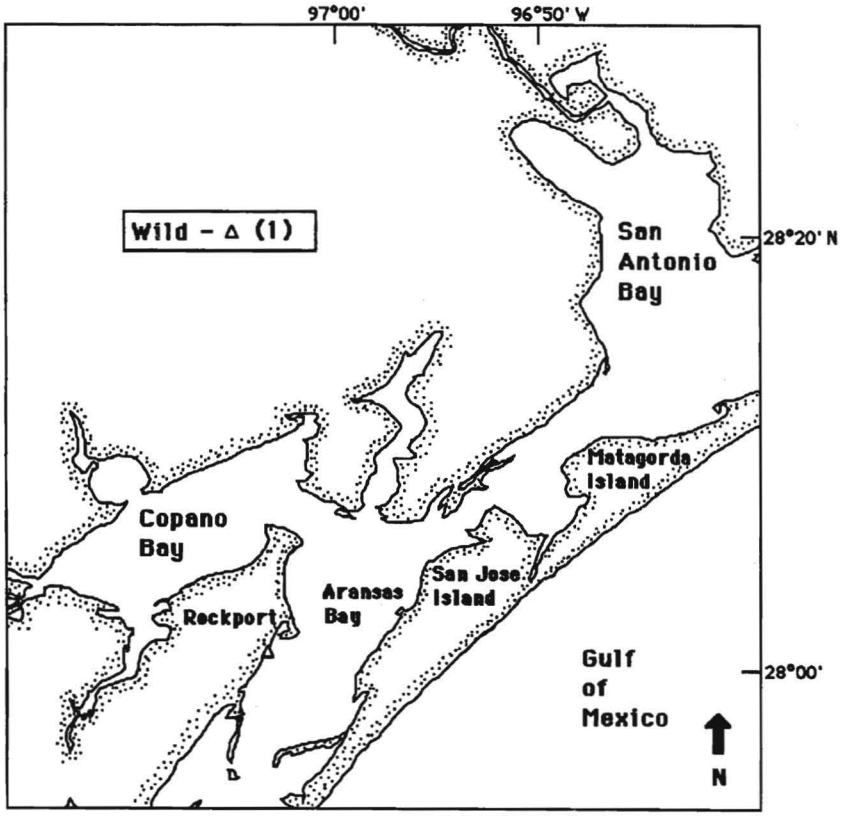
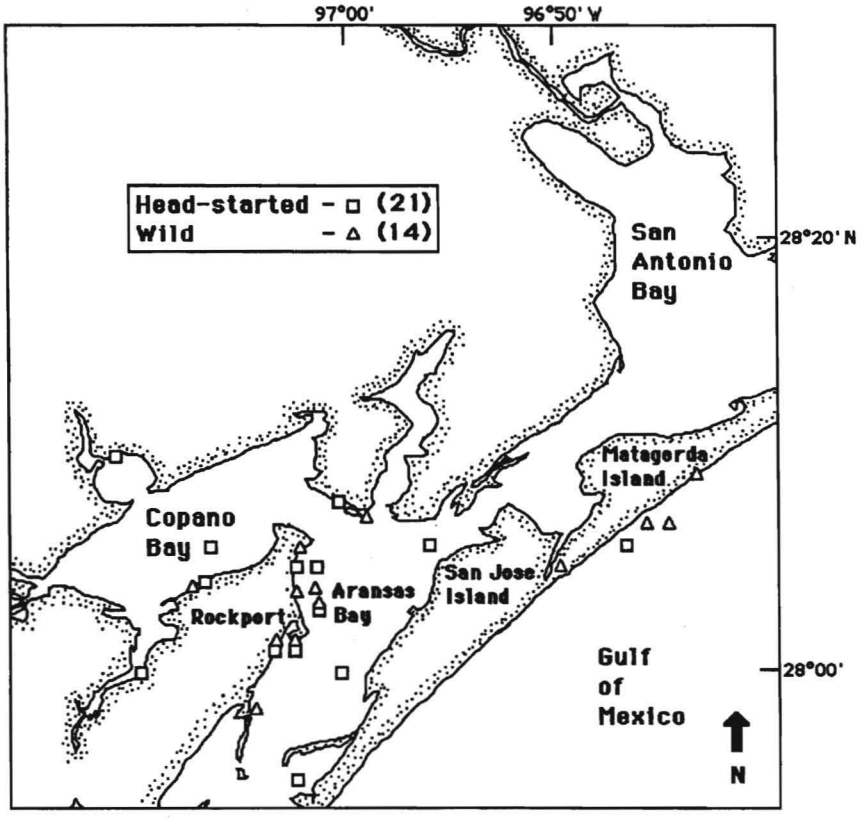


Figure 29 (continued)



< 20 cm



20 - 59.9 cm

Figure 30
Size distribution of Kemp's ridleys in region 5 - San Antonio Bay/Copano Bay/ Matagorda Island.

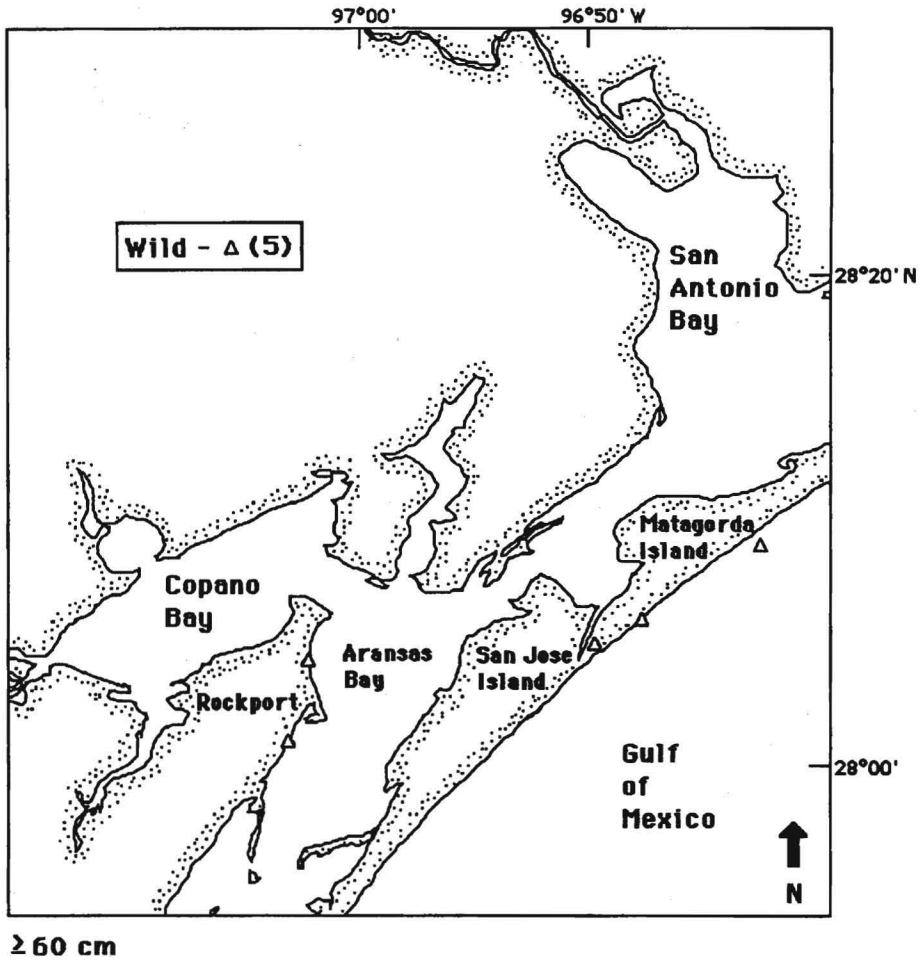
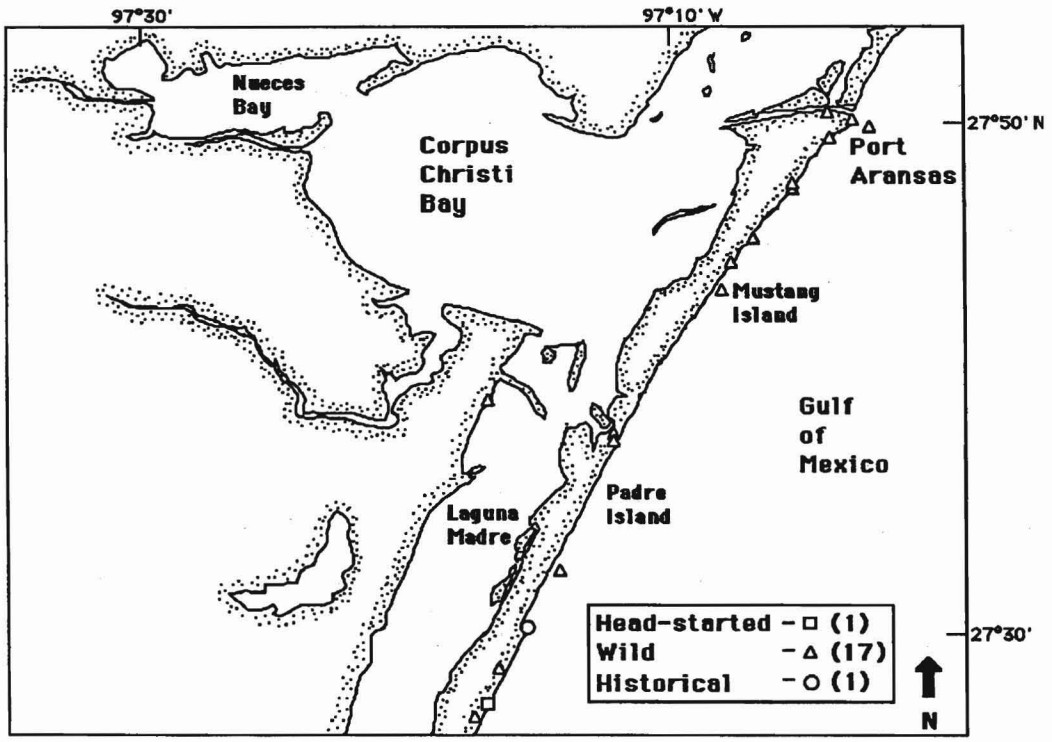
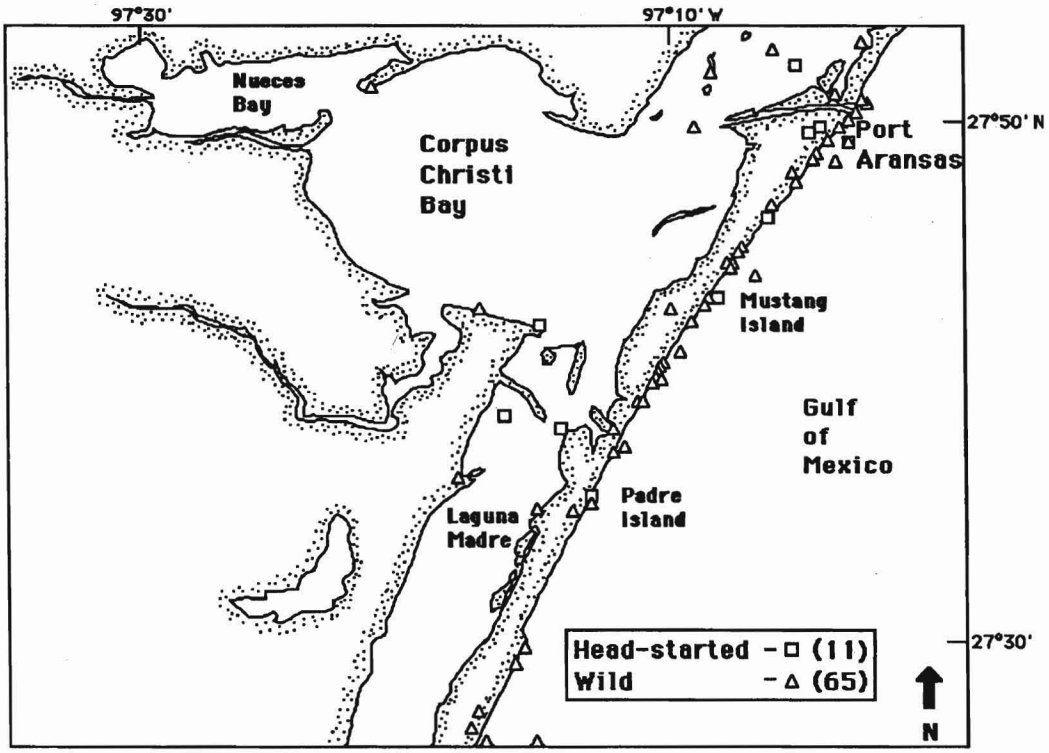


Figure 30 (continued)



< 20 cm



20 - 59.9 cm

Figure 31
Size distribution of Kemp's ridleys in region 6 - Corpus Christi Bay/Northern Padre Island.

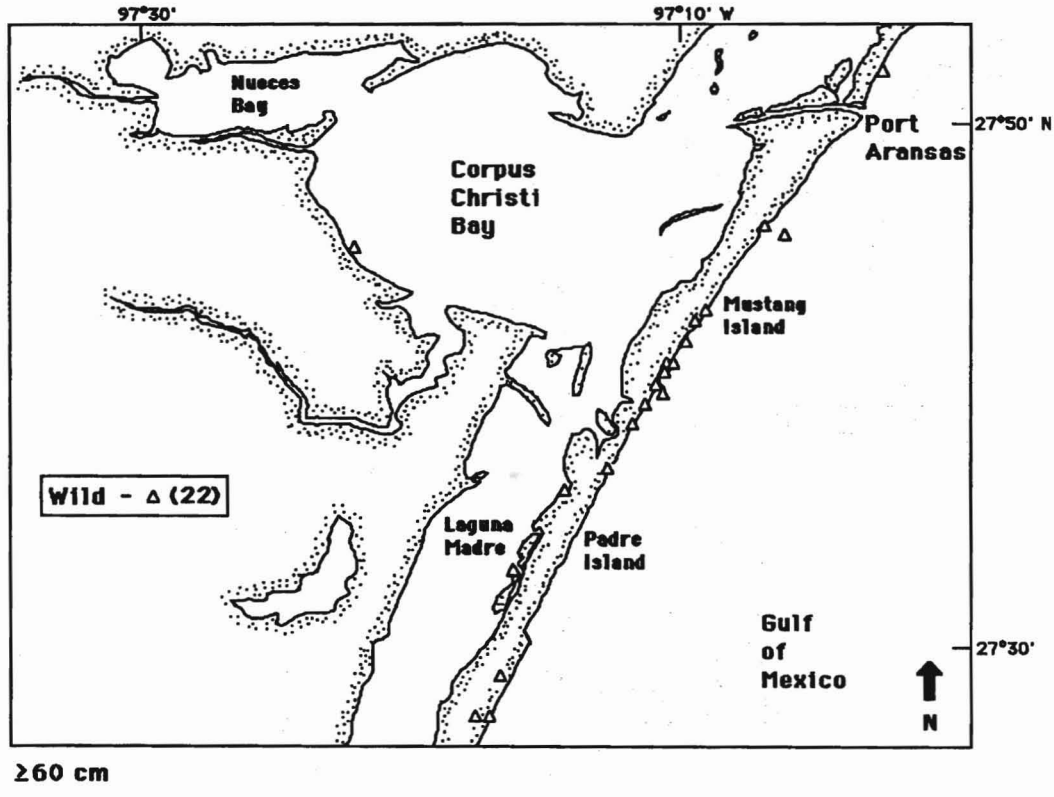
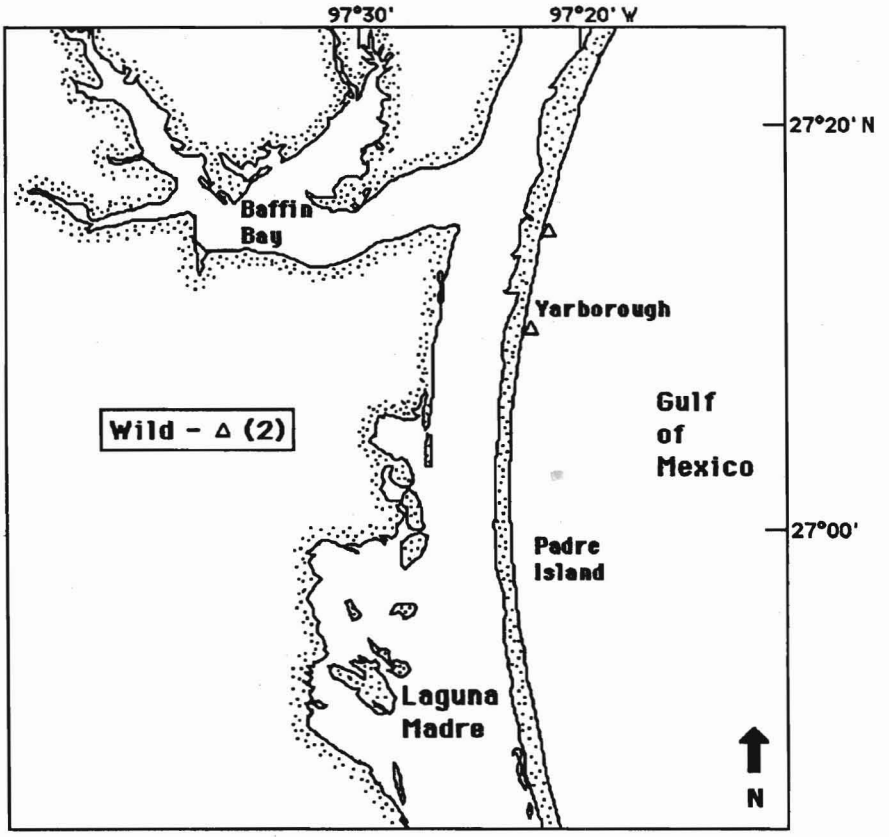
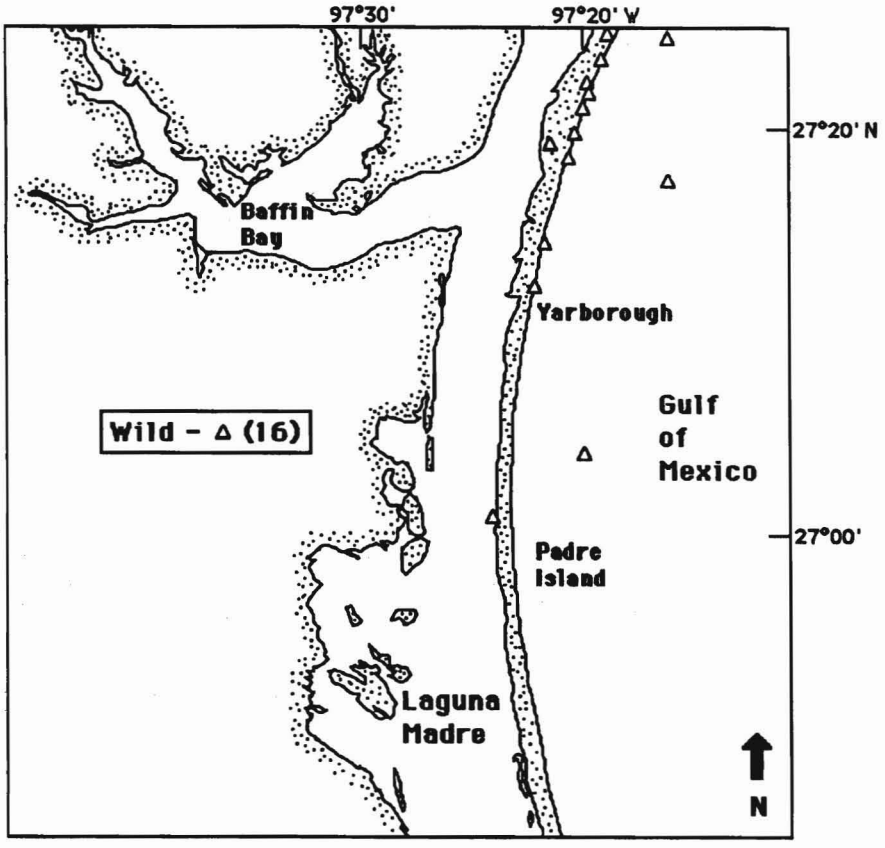


Figure 31 (continued)



< 20 cm



20 - 59.9 cm

Figure 32
Size distribution of Kemp's ridleys in region 7 - Central Laguna Madre/Padre Island.

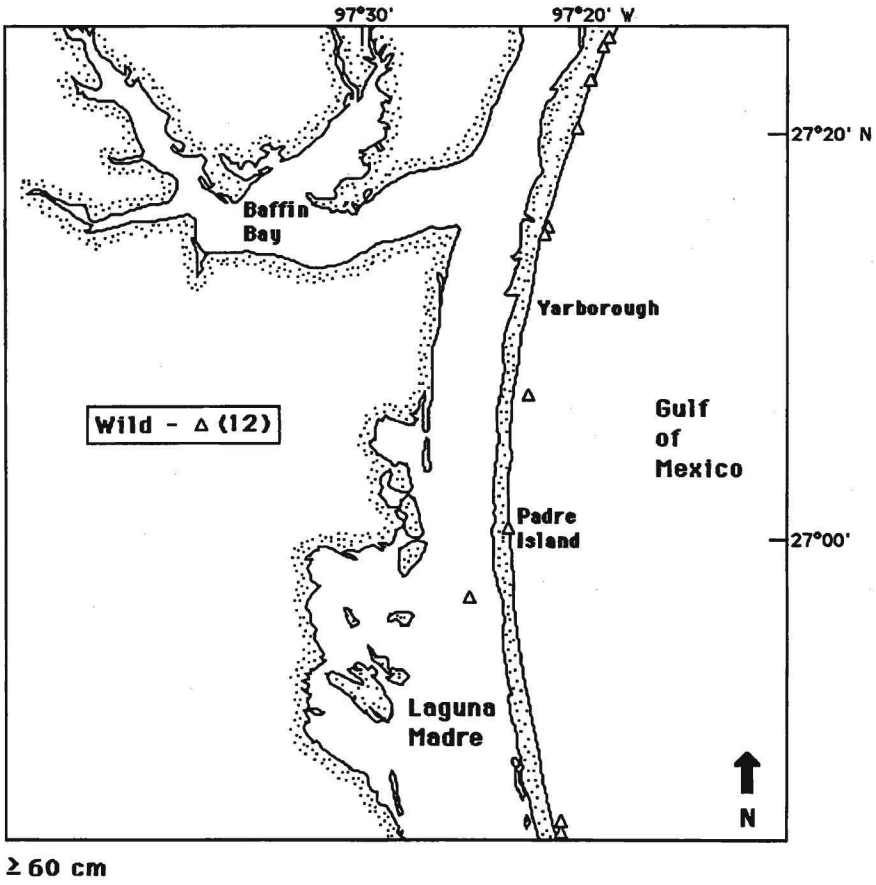
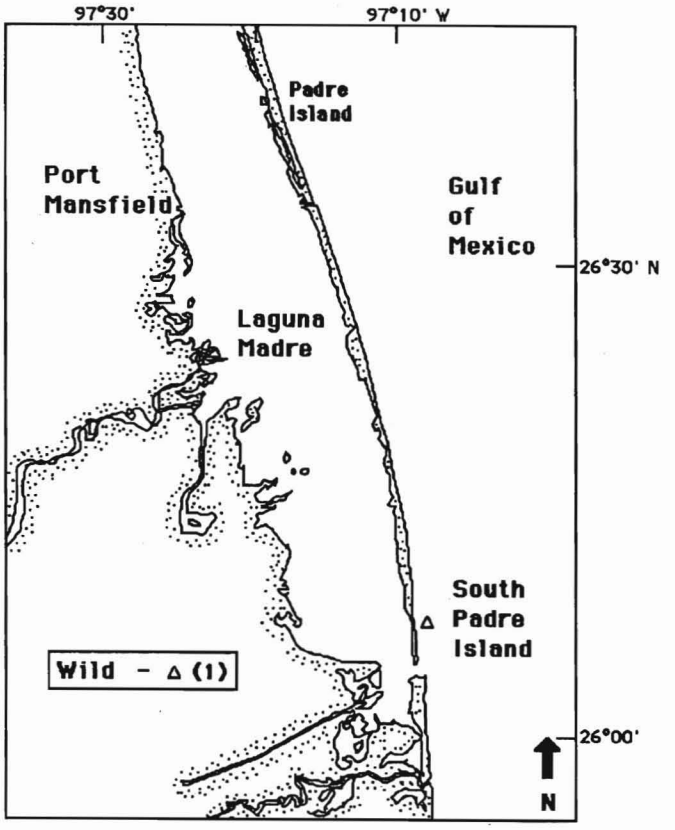
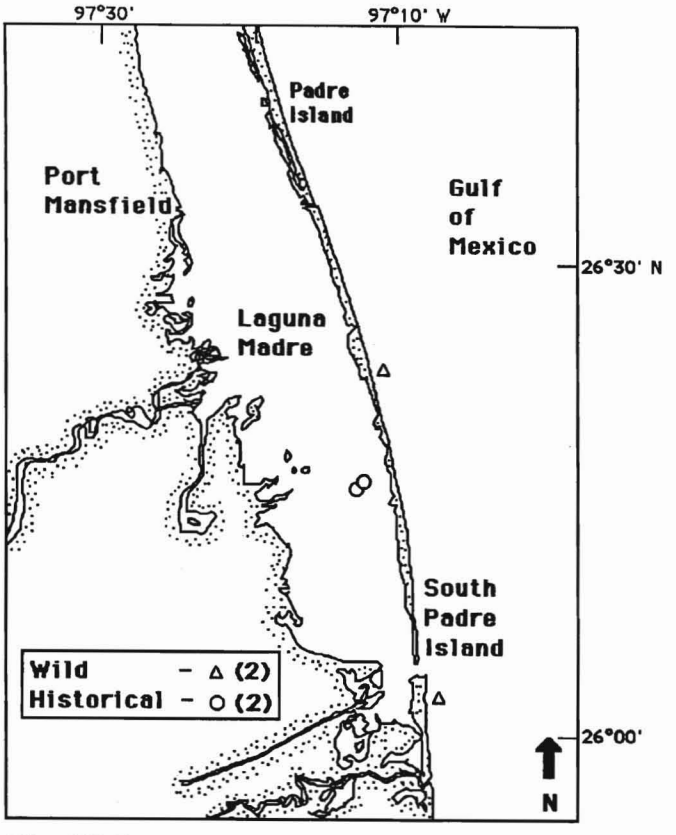


Figure 32 (continued)



< 20 cm



20 - 59.9 cm

Figure 33
Size distribution of Kemp's ridleys in region 8 - Southern Laguna Madre/Padre Island.

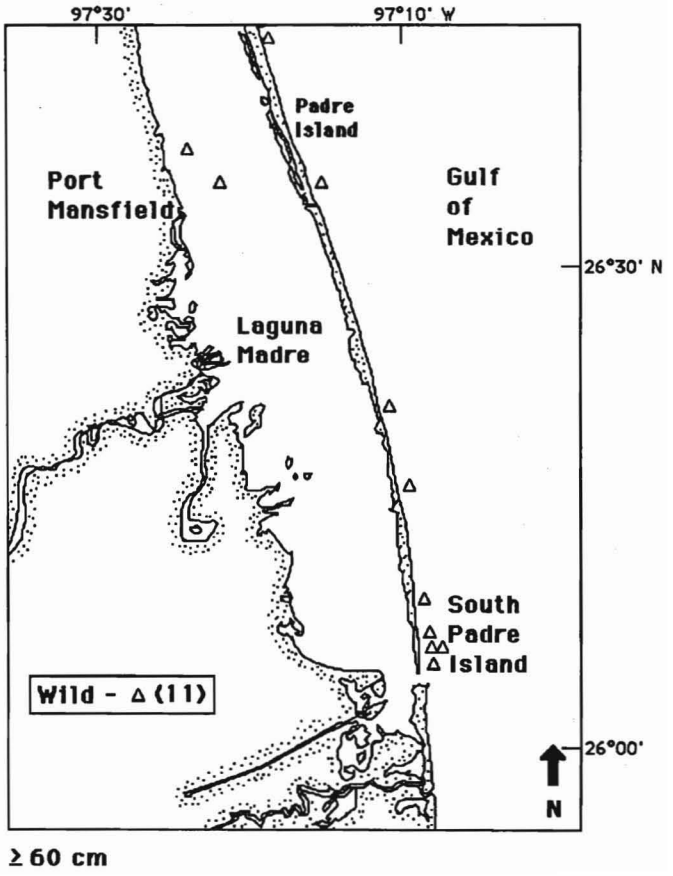


Figure 33 (continued)

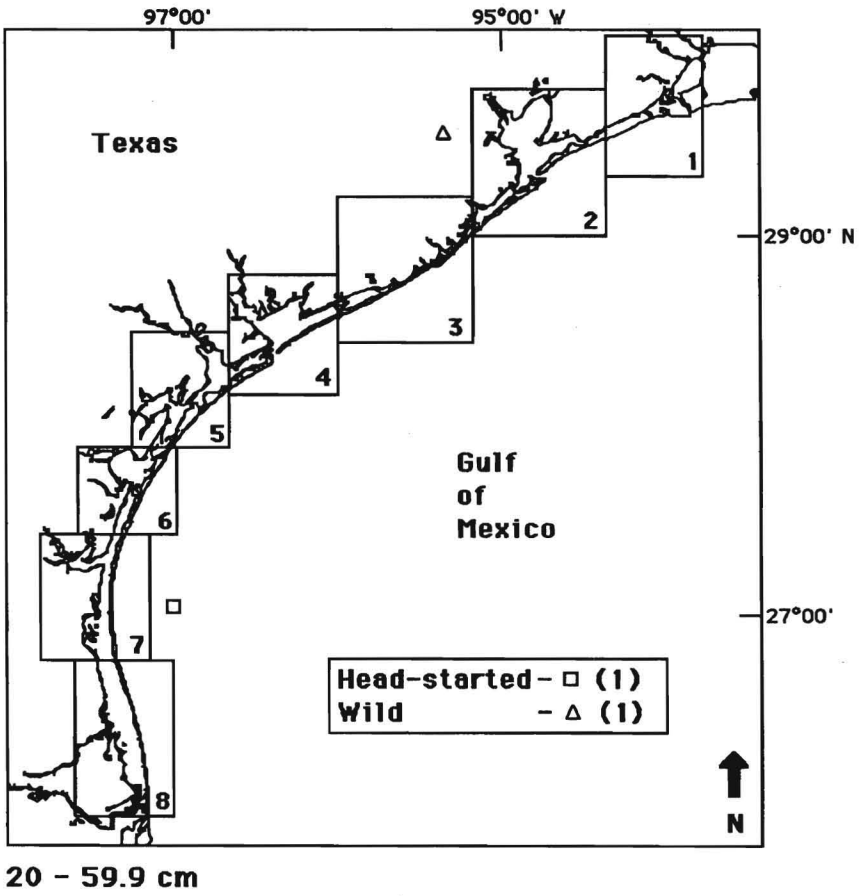


Figure 34
Size distribution of Kemp's ridleys outside the regional boundaries. The wild turtle positioned on land near region 2 was found in a drainage ditch in Houston, TX.